FACTORS AFFECTING THE USE AND NON-USE OF ELECTRONIC INFORMATION RESOURCES IN SCIENTIFIC, TECHNOLOGICAL AND MEDICAL DISCIPLINES AT UNIVERSITIES IN ZIMBABWE

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DECLARATION

I, Gracian Chimwaza, declare that **Factors affecting the use of electronic information resources in scientific, technological and medical disciplines at universities in Zimbabwe** is my own work and that all the sources used and quoted herein have been acknowledged by complete references.

The author, whose name appears on the title page of this thesis, obtained the applicable research ethics approval to conduct the research described in this work. The author declares that he has observed the ethical standards required in terms of the University of Pretoria's Code of Ethics for researchers and the policy guidelines for responsible research.

Signature	Date
Gracian Chimwaza	October 24, 2016

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ABSTRACT

The purpose of this study was to investigate factors affecting the use and non-use of free and low-cost library electronic information resources by information specialists (librarians charged with e-resource responsibilities), academic staff and postgraduate students in scientific, technological and medical (STM) disciplines at universities in Zimbabwe. The research problem was: *What are the factors affecting the use and non-use of e-resources by information specialists, academic staff and postgraduate students in scientific, technological and medical (STM) disciplines at universities in Zimbabwe?*

To address this problem, several sub-questions were set, covering the situation of free and low-cost e-resources available to Zimbabwean universities, factors influencing access to e-resources, the actual use of such resources, and how these problems should be addressed. The study also considered reports from related studies.

Using convenience and purposive sampling depending on the participant group, empirical data were collected from information specialists, academic staff and post-graduate students from five universities in Zimbabwe (Africa University, Chinhoyi University of Technology, Midlands State University, National University of Science and Technology and University of Zimbabwe) from May to July 2015.

Quantitative and limited qualitative data were collected through questionnaires administered to library directors, information specialists, academic staff and post-graduate students in the STM disciplines. Four library directors or their representatives, 38 information specialists, 80 academic staff, 121 master’s and 14 doctoral students were involved in the study. Descriptive statistical data on all four groups and inferential statistical data on information specialists, academic staff and postgraduate students are provided. Content analysis was applied to qualitative data to reveal views on factors affecting the use of e-resources.

The universities provide access to scholarly literature through large collections of e-resources by means of various databases, e-books and electronic theses and dissertations. The availability of journals is no longer a principal problem; the challenge is how to ensure that what is available can be accessed and is used to best

effect. Access to computers is also not a problem, especially for information specialists. There are, however, problems with internet infrastructure (i.e. slow and/or unreliable internet, shortage of internet bandwidth), limited user skills and limited user awareness of available library e-resources.

Inferential statistical data analysis determined that the *position of the information specialist*, whether junior or senior, has an important impact on their use of e-resources. Juniors tended to use e-resources more often than seniors. *Good technical support* when encountering problems with e-resources had the most significant influence on downloading of full-text articles by information specialists.

The general linear model test identified *lack of skills in using the e-resources* as the factor with the highest significance, compared to other variables that had an effect on the use of e-resources by academic staff in STM disciplines. Of the seven significant variables that affected the frequency with which academic staff downloaded full-text articles, the factor of *academic staff duties involving research and supervision of students* had the highest significance value.

On testing factors influencing postgraduate students' frequency of using e-resources and their frequency of downloading full-text articles, *postgraduate students' training on Google Scholar* was established to have the highest significance regarding both.

Recommendations include: improved investment in user skills training and information literacy; tools to improve the discoverability of e-resources and content provided by libraries; effective marketing strategies to improve the use and uptake of e-resources by academic staff and students; ensuring that content covered by e-resources is relevant and up to date; providing technical support to e-resource users when they encounter problems; and ensuring adequate IT and internet infrastructure.

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[1] Authorisation messages to the researcher from three universities (Africa University, Midlands State University and University of Zimbabwe) were personal e-mail messages not published

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LIST OF ABBREVIATIONS AND ACRONYMS

ACU - Association of Commonwealth Universities

AGORA - Access to Global Online Research in Agriculture

AJOL - African Journals Online

ARDI - Access to Research for Development and Innovation

ARL - Association of Research Libraries

CCAL - Creative Commons Attribution License

CLIR - Council on Library and Information Resources

CUT - Chinhoyi University of Technology

DiSCmap - Digitisation of Special Collections: Mapping, Assessment and Prioritisation

DLF - Digital Library Federation

DOAJ - Directory of Open Access Journals

DOI - Digital Object Identifier

EDR - Environmental Data Registry

EIFL - Electronic Information for Libraries

E-journal - Electronic Journal

eJUSt - E-Journal Users Study

EPA - Environmental Protection Agency

E-resources - Electronic Information Resources

FAO - Food and Agriculture Organisation

GNI - Gross National Income

FTE - Full-time Equivalent

HINARI - Health Access to Research Initiative

ICT - Information and Communication Technologies

INASP - International Network for the Availability of Scientific Publications

IP - Internet Protocol

MSU - Midlands State University

NUST - National University of Science and Technology

OARE - Online Access to Research in Environment

PERI - Programme for the Enhancement of Research Information

PLoS - Public Library of Science

PMC - PubMed Central

STM - Scientific, Technical and Medical

TPB - Theory of Planned Behaviour

TAM - Technology Adoption Model

TEEAL - The Essential Electronic Agricultural Library

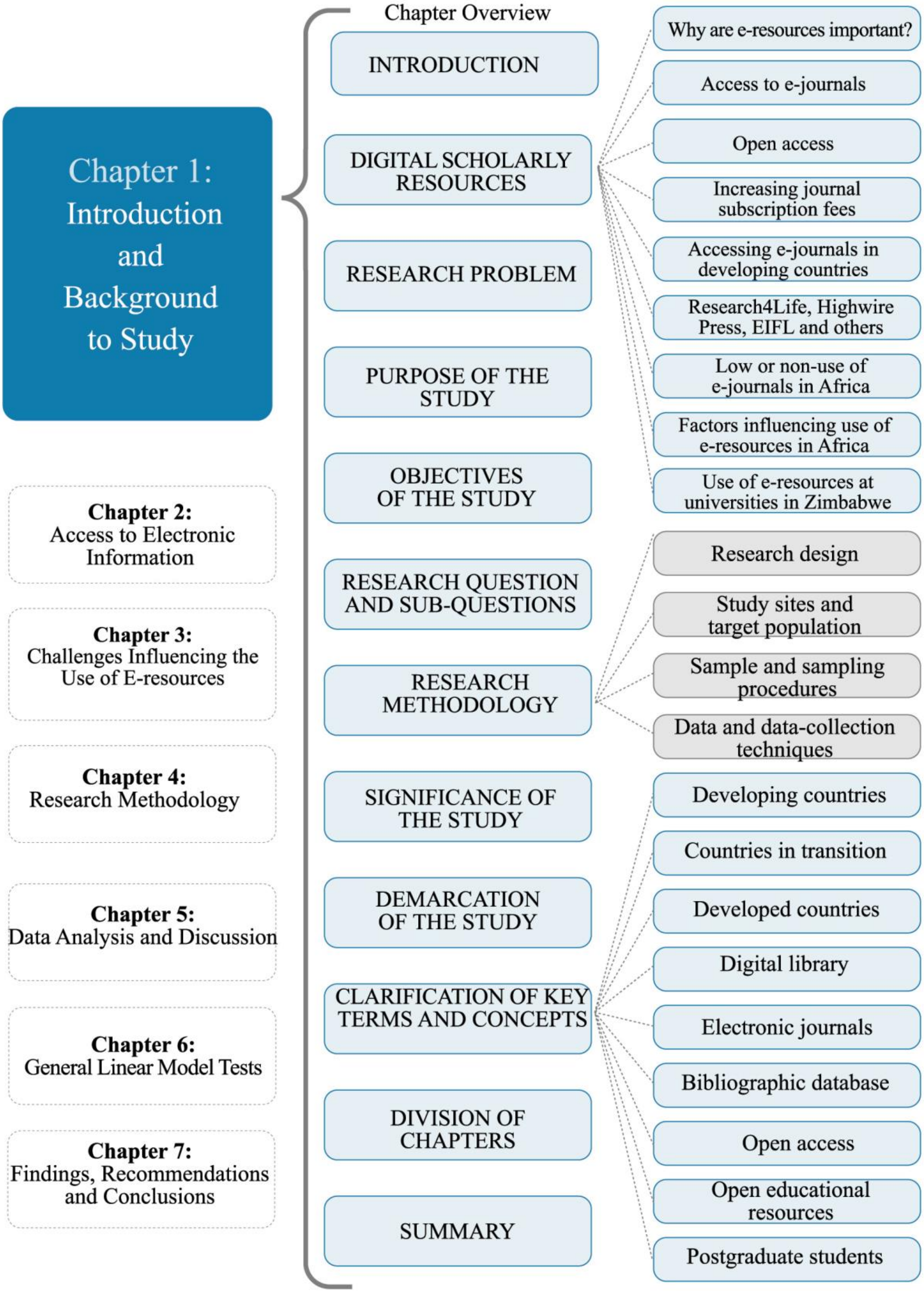
UTAUT - Unified Theory of Acceptance and Use of Technology

UGC-INFONET - University Grant Commission – Information and Library Network

UZ - University of Zimbabwe

WHO - World Health Organisation

CHAPTER ONE: INTRODUCTION AND BACKGROUND TO STUDY



1.1 INTRODUCTION

Access to up-to-date, peer-reviewed published literature is an important contributor to both short-term and long-term development in Africa. Some libraries in developing countries, particularly in Africa, find it difficult to afford and access relevant scholarly literature in any meaningful quantity. Electronic information resources (e-resources) and digital libraries have become more prominent since the 1990s (Fox & Urs, 2002[2]; Bearman, 2007; Amjad, Ahmed & Naeem, 2013; Egle, *et al.*, 2015; Kowalsky, 2015). There are, however, concerns about the use of such resources (Mark Ware Consulting Ltd, 2006; Rosenberg, 2008; Harle, 2009; Amjad, Ahmed & Naeem, 2013; Tripathi & Kumar, 2014; Egle *et al.*, 2015).

1.2 DIGITAL SCHOLARLY RESOURCES

A report by the Association of Research Libraries (ARL) regarding digital scholarship identifies some main types of digital scholarly resources: electronic journals (e-journals), which are published in electronic format only, reviews of scholarly works, preprints and working papers, encyclopaedias and annotated content, data resources such as the Research Collaboratory for Structural Bioinformatics' Protein Data Bank, blogs, discussion forums such as e-mail lists, and professional and scholarly hubs, including the web portals maintained by many scholarly societies (Howard, 2008). Some of these terms are explained in more detail in section 1.7.

The development of online electronic versions of journals has revolutionised scientists' access to literature (Morse & Clintworth, 2000; Mark Ware Consulting Ltd, 2006; Björk, *et al*., 2010; Amjad, Ahmed & Naeem, 2013; Egle *et al*., 2015). According to a global review report by Mark Ware Consulting Ltd (2006), over 90% of science, technology and medical (STM) journals were online at the time, and in many cases publishers had retrospectively digitised earlier hard copy material back to the first volumes. Kurata *et al.* (2007), Amjad, Ahmed and Naeem (2013), Egle *et al.* (2015), Kowalsky (2015) and Mansour (2016) support the view that e-resources are in common use in scholarly communication.

According to an ARL report, e-journals resemble print journals with regard to editorial guidelines, peer review and a well-defined scholarly mission. They receive more citations from scholars and digital reviews of scholarly research are increasing (Howard, 2008; Pienaar, 2008; Tripathi & Kumar, 2014). Scholars are learning to exploit the digital-era advances of speedy access to new work, the open access model, and the benefits of being part of a network or online community of scholars that e-resources offer (Mark Ware

[2] In-text references are organised according to year of publication – oldest references first. When there is more than one reference from the same year, references are in alphabetical order according to author.

Consulting Ltd, 2006; Geraldine, 2013; Samson, 2014; Egle *et al*., 2015; Pons *et al*., 2015; Kumar & Reddy, 2016).

Ulrich's International Periodicals Web Directory listed 336 000 active, peer-reviewed scholarly or academic journals by 2017 collectively publishing about 2.5 million articles a year (http://www.ulrichsweb.com). This study started in 2009.

Mark Ware Consulting Ltd (2006) argues that the number of peer-reviewed journals published annually has been growing at a steady rate of about 3.5% per year because of the growth in the number of scientific researchers in the world. Most of these journals are available online. A similar study by Cox in 2005 (based on a publisher survey) found 90% of all journals were online at the time, including 93% of STM and 84% of arts and humanities journals (Cox, 2010). According to Khabsa and Giles (2014), estimates show that at least 114 million English-language scholarly documents are accessible on the web, of which Google Scholar has nearly 100 million. Of these, they estimate that at least 27 million (24%) are freely available, since they do not require a subscription or payment of any kind. This sets the scenario for the potential use of e-journals.

1.2.1 Why are e-resources important?

E-resources have revolutionised access to up-to-date research outputs. The emergence of digital library resources in the past two decades has seen a rapid increase in the types and sizes and collections offered to users by libraries especially at academic and research institutions (Samson, 2014; Egle *et al*., 2015). This development has had a significant impact on how academics and researchers access up-to-date scholarly literature and the production and publication of their own research (Mark Ware Consulting Ltd, 2006; Kurata *et al*., 2007; Amjad, Ahmed & Naeem, 2013; Tripathi & Kumar, 2014; Egle, *et al.,* 2015). Sections 2.3.1 and 2.3.2 discusses these points in more depth.

1.2.2. Access to e-journals

Online peer-reviewed journals are either free or accessible by subscription. Fee-based journals are subscribed to by institutions and individuals either directly to the publishers or via brokers, i.e. gateways such as Science Direct (www.ScienceDirect.com), a digital platform of Elsevier's that provides access to over 2 500 full-text STM journals and about 30 000 books (http://www.sciencedirect.com). In the developed world, most subscriptions are fee-based and universities and research institutions pay millions of dollars annually to access journals (Teskey & Urquhart, 2001; McCabe, 2002; House of Commons Science and

Technology Committee, 2004; Turner, 2014; Lawson, 2015; Coughlin, Campbell & Jansen, 2016).

Over the years publishers have adopted flexible online journal licensing terms to meet user needs (McCabe, 2002; House of Commons Science and Technology Committee, 2004; Kaser, 2009; Kaplan, Killough & Thomas, 2012; Amjad, Ahmed & Naeem, 2013). Some licences include unlimited access via internet protocol (IP) recognition, access rights for walk-in users, perpetual access to paid content, and the right to download articles and make copies for course packs and e-reserve collections – all of which are good for libraries and their patrons (Roberts, 2001; Kaser, 2009; Coughlin, Campbell & Jansen, 2016).

Depending on the service provider, there may be embargoes on journals (McCabe, 2002; Brooks, 2003; Khabsa & Giles, 2014). An embargo is a period of time during which electronic copies of a journal are not available. The period varies according to the service provider and the licensing restrictions of the journal publisher (Prosentient Systems, 2009; Geraldine, 2013). For instance, a journal provider may not allow the electronic version of an open access journal to be accessed for the first 12 months after publication.

Access to journals can also be through bibliographic database gateways such as EBSCO host (www.ebscohost.com), which is an electronic index to journal articles, containing citations, abstracts and often the full text of the articles indexed. Similarly, Google Scholar (http://scholar.google.co.za), African Journals Online (AJOL) (www.ajol.org) and CAB Abstracts (www.cabi.org/datapage.asp?iDocID=165) offer journal article abstracts and links to full-text articles where available. CAB Abstracts is a comprehensive database giving access to over 5 million records covering the applied life sciences.

1.2.3 Open access

The internet has made possible the free global availability of scientific journal articles (Björk *et al.*, 2010; Khabsa & Giles, 2014; Chen & Du, 2016). Open access implies making original research freely available on the web, ideally immediately on publication (Salem & Boumil, 2013). Open access is strictly speaking a property of an article rather than a journal (Mark Ware Consulting Ltd, 2006). For instance, the Public Library of Science (PLoS) applies the Creative Commons Attribution License (CCAL) to all work it publishes. Under the CCAL, authors retain ownership of the copyright of their article, but they may allow anyone to download, reuse, reprint, modify, distribute, and/or copy articles in PLoS journals, as long as the original authors and source are cited. No permission is required from the authors or the publishers (Gasparyan, Ayvazyan & Kitas, 2013; Salem & Boumil, 2013).

Kaser (2009) and Chen and Du (2016) argue that there are generally two approaches (or "routes") to open access:

- Open access publishing – the "gold" route, whereby the journal makes the article freely available, as does BioMed Central, now a division of Springer and PLoS journals; and
- Open access self-archiving – the "green" route, where the authors (or someone acting on their behalf) deposit a version of the published article, typically a pre- or post-print, in an open repository. There are numerous variants on each of these approaches (Beckett & Inger, 2007; Kaser, 2009; Björk *et al.*, 2010; Gasparyan, Ayvazyan & Kitas, 2013; Chen & Du, 2016).

In addition to open access journals there are free journals available online, such as *Information Research* (http://informationr.net/ir). *Information Research* is a freely available, international, scholarly journal, dedicated to making accessible the results of research across a wide range of information-related disciplines. Several initiatives have come up over the years offering free journals, spurred on by the Open Archives Initiative (www.openarchives.org), which is dedicated to establishing metadata tagging conventions that will allow all open archives to be interoperable (Harnad, 1999). Examples of free journal initiatives are the Directory of Open Access Journals (DOAJ) (www.doaj.org), Free Electronic Journals (www.library.unr.edu/ejournals/free.aspx), the Free Medical Journals (www.freemedicaljournals.com) and PubMed Central (PMC) (www.pubmedcentral.nih.gov). PMC is the US National Institutes of Health's free digital archive of biomedical and life sciences journal literature. All articles in PubMed Central are free (sometimes on a delayed basis). Free initiatives leave the rights of reproduction, redistribution and reuse with the authors (US National Institutes of Health, 2009; Salem & Boumil, 2013; Di Salvo *et al.*, 2015).

1.2.4 Increasing journal subscription fees

The prices of for-profit academic journals have increased rapidly over the past decade (Nevo, Rubinfeld & McCabe, 2005; Day, 2010). Substantial debate on the explanation for these increases is taking place. The publishers have argued that price increases are justified by cost increases, while their customers do not seem to agree with the claims (Day, 2010). According to the ARL (2005), the annual price rise for peer-reviewed journals over the period 1984-2004 was 7.6%, outpacing average global inflation of 3.3%. By 2005, subscription fees averaged $1 000 - $3 000 per annum for STM journals (Mark Ware Consulting Ltd, 2006).

These high prices have caused many developing-country institutions to cut subscriptions to journals year after year (Day, 2010; Bernardini & Mangiaracina, 2011). Even in developed countries, the cost of subscriptions is a major factor for purchasing decisions on e-resources (Teskey & Urquhart, 2001; Mathangani, 2005; Day, 2010; Turner, 2014; Lawson, 2015; Coughlin, Campbell & Jansen, 2016).

1.2.5 Accessing e-journals in developing countries

According to a 2000 survey by the World Health Organisation (WHO), researchers and academics in developing countries rank access to "priced literature" (i.e. journals) as one of their most pressing problems (Aronson, 2004). The report states that in countries with annual incomes of $1 000 and less per person, 56% of institutions surveyed had no current subscriptions to international journals. In the next tier ($1 000 - $ 3 000 gross national product per capita per year), 34% had no current subscriptions and another 34% subscribed to only two to five journals. This position is confirmed by the Mark Ware Consulting Ltd report (2006) and is still a great concern (Björk, Roos & Lauri, 2008; Bernardini & Mangiaracina, 2011; Amjad, Ahmed & Naeem, 2013; Coughlin, Campbell & Jansen, 2016).

A number of schemes providing free or heavily discounted access to scientific literature to researchers in developing countries have emerged in an attempt to reduce the gap in access to e-resources between developing countries and developed countries (Di Salvo, 2015; Malapela & De Jager, 2015; Tamrakar & Garg, 2016). Some of the more notable ones are Research4Life, HighWire Press, Electronic Information for Libraries (EIFL), DOAJ, The Essential Electronic Agricultural Library (TEEAL) and the Programme for the Enhancement of Research Information (PERI) of the International Network for the Availability of Scientific Publications (INASP). Yet there are concerns about how these resources are used (Rosenberg, 2006; Tripathi & Kumar, 2014; Egle *et al*., 2015; Malapela & De Jager, 2015).

1.2.6 Research4Life, HighWire Press, EIFL, DOAJ, TEEAL and PERI programmes

Since November 2015 Research4Life **(**www.research4life.org) has offered four programmes, i.e. Health Access to Research Initiative (HINARI), Access to Global Online

Research in Agriculture (AGORA), Online Access to Research in Environment (OARE) and Access to Research for Development and Innovation (ARDI) (Research4Life, 2015).

(1) HINARI

HINARI (www.who.int/hinari) was launched in January 2002 by the WHO through collaboration with international publishers and Yale University Library. The programme offers free access to over 14 000 journals and 46 000 e-books available to health institutions in countries with the lowest per capita incomes, and access for a nominal fee ($1 500 for the full collection) for the next band of countries (108 countries in total). Over 400 publishers offer more than 60 000 information resources in HINARI and many others are joining the programme (Research4Life, 2015). Zimbabwe falls in the lowest per capita income bracket.

(2) AGORA

HINARI's sister programme, AGORA (www.fao.org/agora), was launched in 2003 and provides free access to the journal literature in food and agriculture. It is led by the United Nations Food and Agriculture Organisation (FAO).

(3) OARE

A third Research4Life programme, called OARE (www.oaresciences.org), was launched in 2006. It is dedicated to environmental sciences. OARE is led by the United Nations Environment Programme and works in collaboration with Yale University and leading science and technology publishers.

(4) ARDI

Research4Life's fourth programme, ARDI (www.wipo.int/ardi), provides e-journals and e-books for technology innovations and joined the initiative in 2010 (Research4Life, 2015). The programme is led by the World Intellectual Property Organisation. .

(5) HighWire Press

HighWire Press (http://highwire.stanford.edu) offers free access for developing countries to a list of 1 700 high-quality journals and thousands of e-books, based simply on software that recognises where the user is accessing the site from.

(6) EIFL

EIFL (www.eifl.net) provides country-wide access to thousands of titles in social sciences, the humanities, business and management by libraries in about 60 selected low-income countries.

(7) DOAJ

DOAJ (www.doaj.org) is a service that covers free, full-text, quality-controlled scientific and scholarly journals in all subjects and languages. By November 2015 there were 10 533 journals in the directory and of these, 6 439 journals were searchable at article level. More than 2 million articles were included in the DOAJ service.

(8) TEEAL

TEEAL (www.teeal.org) is an offline resource providing access to full-text international core journals in agricultural and related sciences to low-income countries at highly discounted prices. Eligible institutions pay $750 a year to acquire the 500-journal collection delivered on a mini-networkable computer. Users do not need an internet connection to access the full-text articles.

(9) PERI

PERI is an initiative by INASP (www.inasp.info) launched in 2001. According to Manda (2005:269), "PERI was the first far reaching attempt to introduce the use of full-text electronic journals in the research and academic community in Sub-Sahara Africa." PERI's main objective is to facilitate the acquisition of international information by researchers in developing countries. This is done through the acquisition of full-text online journals, current awareness databases and document delivery offered through bibliographic databases such as EBSCO host, with links to full-text articles (Manda, 2005). This service is offered at heavily subsidised subscription rates to institutions of higher learning through a country library consortia licensing model (Mbambo, 2006; Harle, 2009).

Table 1.1 (section 1.2.6) lists the e-journal services available to developing countries.

1.2.7 Low use or non-use of e-journals in Africa

The common key function of the above-mentioned programmes is providing free access to full-text articles in peer-reviewed journals (Malapela & De Jager, 2015). This allows users in the institutions to download the articles and access up-to-date literature otherwise often inaccessible to researchers in developing countries. Though use of e-resources by researchers and students in general is gradually increasing internationally, many problems slow down the wide uptake of e-resources (Tripathi & Kumar, 2014; Egle *et al*., 2015). According to Lawal (2002) exorbitant prices of STM journals and library budget constraints often prevent institutions from purchasing needed journals, as argued in section 1.4. Lawson (2015) makes the same point.

It is also argued that "there is still considerable confusion and lack of awareness amongst some academics and students about what is available in terms of electronic resources i.e. subject gateways, electronic databases and e-journals" (Teskey & Urquhart, 2001:243). The findings of several studies, including a study carried out at the University of the West of England into the use of e-journals by academics and their attitudes towards them, suggest that while there is a high level of interest in and acceptance of e-journals in the academic community, their use is limited (Nelson, 2001; Keiser, 2014). According to Tomney and Burton (1998) and Ajuwon and Olorunsaye (2013), although the actual number of academics using e-journals is generally low, academics are willing to try this new medium. Ganu (1999), Teskey and Urquhart (2001) and Asamoah-Hasan and Fremong (2008) further argue that there is a great diversity of skills and knowledge among users and that there are definite differences between disciplines in take-up and use of e-journals, with students in science, medicine and social science using e-journals most. Nelson (2001), Ajuwon and Olorunsaye (2013) corroborate this point and add that in some cases this can be explained by a lack of a significant body of e-journals in a particular discipline. In the case of most STM disciplines this is, however, not the case. Thousands of journals are now available through several e-journal initiatives, such as the PERI and Research4Life programmes (Malapela & De Jager, 2015).

Teskey and Urquhart (2001), Mlambo (2010) and Ajuwon and Olorunsaye (2013) highlight other issues, such as lack of awareness of what is available, lack of IT skills and lack of access to appropriate hardware and software. Pullinger (1999) and Egle *et al*. (2015) specify that academic use of journals is influenced by many factors, including users' subject disciplines, their roles or level in the university, their local information environment of print and electronic resources, awareness of those resources and their information needs on a particular day. Table 1.1 portrays e-journals available to developing countries in October 2016.

Table 1.1: E-journal services available to developing countries[3]

Platform	Details	Eligibility
AGORA (www.fao.org/agora)	AGORA provides a collection of 6 100 full-text journals and 5 800 e-books in 108 countries. It aims to enable developing countries to gain access to an outstanding digital library collection in the fields of food, agriculture, environmental science and related social sciences and was launched by the FAO on 14 October 2003 in collaboration with major international publishers. Over 2 900 developing country institutions were registered by November 2015.	Free access to institutions in countries with gross national income (GNI) per capita below $1 250. Institutions in countries with GNI per capita between $1 250 and $3 500 pay a fee of $1 000.
EIFL (www.eifl.net)	Thousands of full-text journal articles in mainly science fields and available to developing countries. EIFL.net established six core programmes, which enable and sustain access to knowledge by library users in developing and transitional countries.	Free access to eligible developing countries.
DOAJ (www.doaj.org)	By November 2015 there were 10 533 journals in the directory, including over 2 million articles. The service aims to cover all subjects, but mainly agricultural, health and biosciences sciences, social sciences, arts, history, business and general sciences. The service is provided by Lund University Libraries and covers free, full-text, quality-controlled scientific and scholarly journals.	Free access to full-text journal articles for all developing countries.
HINARI (www.who.int/hinari)	HINARI provides access to over 14 000 full-text journals and 46 000 e-books to eligible health institutions in 108 countries, areas and territories. Set up by the WHO in 2002, together with major publishers, it enables developing countries to gain access to one of the world's largest collections of biomedical and health literature. Over 5 700 institutions had registered for HINARI by November 2015.	Free access to institutions in countries with GNI per capita below $1 250. Institutions in countries with GNI per capita between $1 250 and $3 500 pay a fee of $1 000.
PERI	Over 8 000 full-text journals available to eligible low-income countries at heavily	INASP supports and negotiates access to

[3] Sources: relevant programme websites available 31 October 2016

(www.inasp.info)	discounted prices. Developed by INASP and launched in 2001.	online resources in developing countries for higher education and research institutions. Available mostly to East and Southern African countries.
OARE (www.oaresciences.org)	Over 6 500 full-text peer-reviewed titles and 38 000 e-books on environmental science research owned and published by over 350 prestigious publishing houses and scholarly societies. About 2 800 institutions had registered for OARE by November 2015.	Free access to institutions in countries with GNI per capita below $1 250. Institutions in countries with GNI per capita between $1 250 and $3 500 pay a fee of $1 000.
TEEAL (www.teeal.org)	Over 500 full-text agricultural science journals delivered offline on hard drive to subscribing institutions. Supplied by Mann Library, Cornell University, United States of America, since 1999.	Cost $750 per annum to eligible institutions in 113 low-income countries.

Bernardini and Mangiaracina (2011) and Jotwani (2014) argue that embargoes also contribute to the problem of low use of e-journals. They further argue that this practice has existed for many years, since it benefits publishers and journalists. Science is supposed to progress through rapid communication of results among scientists, but the embargo system is a barrier to such free exchange of information (Lawal, 2002; Melero *et al*., 2014).

In developing countries, use of e-resources remains low despite several initiatives to provide *free, low-cost and open access* to thousands of full-text scholarly journals, as explained in section 1.5 (Scott, 2006; Ajuwon & Olorunsaye, 2013; Geraldine, 2013) and portrayed in Table 1.1. User statistics and usage logs of article previews and downloads (the frequency each article is actually copied from the source file over the internet by a user) confirm this position (Scott, 2005; Jotwani, 2014; Samson, 2014; Malapela & De Jager, 2015).

Aronson (2005), Ochs (2005), and Scott (2006) argue that before the arrival of electronic library sources such as HINARI and TEEAL, some libraries in developing countries would not have received any learned scholarly journals in five years or more.

1.2.8 Factors influencing use of e-resources in Africa

A number of studies undertaken in the mid- to late 1990s, notably Diana's three-volume 1997 study of 11 countries in Sub-Saharan Africa, capture the emergence of the use of information and communication technologies (ICT) in African libraries and provide a valuable historical picture against which the contemporary situation can be set (Weihs, 1991; Levey, 1993; Malapela & De Jager, 2015; Akporhonor & Akpojotor, 2016).

Budgetary constraints, the lack of reliable internet infrastructure and lack of user skills, among other factors, are reported to play a major role in the use of e-resources at African institutions (Ochs, Aronson & Wu, 2004; Aronson, 2005; Ochs, 2005; Scott, 2006; Ajuwon & Olorunsaye, 2013; Oyewo & Bello, 2014; Akporhonor & Akpojotor, 2016). According to Rosenberg (2006), much training has taken place over the years in the use of programmes such as AGORA, EIFL, HINARI and PERI, and yet journal articles written by African librarians still emphasise problems such as lack of resources (both material and human), the cost of connectivity, power outages, etc, rather than achievements. Issues such as online user authentication, use of passwords and poor bandwidth have also been noted as barriers to access to e-resources (Ajuwon & Olorunsaye, 2013; Akporhonor & Akpojotor, 2016).

1.2.8.1 Lack of funding

Budget cuts at libraries due to lack of funds have exacerbated the problem of journal subscriptions at universities in Africa. According to Rosenberg (2006), all e-resource infrastructure development (what she refers to as "e-development") has depended heavily on external funding and will continue to do so in the foreseeable future. She further argues that lack of funding and lack of or retention of trained staff are the key challenges for the future of e-resource use. Many university libraries have stopped subscribing to journals, leaving students and lecturers to work with outdated literature (Ochs, 2005; Scott, 2006). With free access to journals, as shown in Table 1.1, this should not be a big problem for libraries in Africa.

1.2.8.2 Lack of infrastructure

High internet bandwidth costs and limited numbers of computers have been shown to be among the problems keeping academic institutions in developing countries from benefiting fully from e-resources (Ochs *et al*., 2002; Ochs, 2005; Scott, 2006; Wema & Manda, 2011; Ajuwon & Olorunsaye, 2013). E-resources are available to the majority of libraries in developing countries (as shown in Table 1.1), but facilities for access are poor (Rosenberg, 2006; Mavodza, 2014; Di Salvo *et al*., 2015).

In 2004, INASP commissioned a survey to determine the state of digitisation in university libraries in Sub-Saharan Anglophone Africa, excluding South Africa (Rosenberg, 2006). The survey found that just over 30% of libraries were connected to a university-wide network, but as many as 85% of the libraries in the survey provided fewer than one computer for every 100 full-time equivalent (FTE) students and 36% provided fewer than one computer for every 500 FTE students. Only 35% of the libraries had 75% or more of their computers connected to the internet; 15% of the libraries were not connected at all. Connection was usually through a very small aperture terminal system. Half the libraries that were connected said that slow speeds and problems with reliability were barriers to the use of e-resources. Journal support programmes offering discounted or free full-text access to bundled publisher packages were available in all 20 countries surveyed. However, computer and internet infrastructure is still a stumbling block (Rosenberg, 2006; Echezona & Ugwuanyi, 2010; Mavodza, 2014; Akporhonor & Akpojotor, 2016).

1.2.8.3 Users lack skills

Inadequate use of e-resources and especially free and low-cost e-resources are sometimes linked to a lack of user skills (Agaba, 2004; Rosenberg, 2006; Ajuwon & Olorunsaye, 2013; Kumar & Reddy, 2016; Spiranec, Zorica & Kos, 2016). Advances in the accessibility of electronic information are occurring so rapidly that librarians and library users who have barely learned to operate CD-ROM technology are expected to benefit from sophisticated computer software programs and search and retrieve information over local area networks and the internet (Griffiths, 2003; Chimwaza *et al*., 2006; Junni, 2006; Rosenberg, 2006; Ajuwon & Olorunsaye, 2013; Kumar & Reddy, 2016). For information managers the task is even more challenging. They need to know how to create digital library services and train their clients to use them. They themselves, however, need training and training materials (Keene, 2004; Fisher *et al*., 2008; Chimwaza *et al*., 2010). Griffiths (2003), who studied users' perceptions of information services, found that students are not very adept at evaluating the quality of online scholarly publications, since they seem confused about the actual meaning of quality scholarly publications. In this sense it can be considered very important that students are taught to seek and evaluate information on the internet (and elsewhere) effectively (Griffiths, 2003; Gottwald *et al.,* 2006; Nelson & Huffman 2015; Kumar & Reddy, 2016).

Even in developed countries, information literacy (IL) is often still only poorly developed (Irvin, 2007; Jackson, 2008; California State University, 2009). A commissioned report for Germany's Federal Ministry of Education and Research on the use of electronic scientific information in university education in that country revealed that the use of electronic scientific information is neither a constituent part of the curriculum, nor are students in a position to assess and to optimally exploit electronic information media (Klatt, Gavriilidis & Kleinsimlinghaus, 2001). The University of Central Florida (2006) noted similar trends, and some years later Gonzalez-Rodriguez and Kostakis (2015) argued that it was still the case.

1.2.9 Use of e-resources at universities in Zimbabwe

To date, little research has been carried out to establish the factors affecting the use and non-use of these e-resources at universities in Zimbabwe (Mbambo-Thata, 2007; Mavodza, 2014; Mugwisi, Ocholla & Mostert, 2014; Malapela & De Jager, 2015; Tshuma *et al.*, 2015). There is especially a need to establish the factors affecting the effective use of e-resources in the STM fields by academic staff, students and information specialists at universities in Zimbabwe.

Zimbabwe's economy has experienced a major downturn in the past decade. According to the World Bank Group Report (2008), in the period 1997-2007 the country's gross domestic product shrank by 5% a year, and inflation peaked at 1 500% in 2007, the world's highest. In the period 2000-2006 telephone (landlines) density only grew from 2 to 2.5 per 100 people, while the number of internet users grew from 0.4 to 9.2 per 100 people in a population of about 13 million (World Bank, 2008). In February 2009 the government introduced the use of multicurrency, with the American dollar and South African rand as the main currencies, to curtail inflation. According to the Reserve Bank of Zimbabwe, in the 2014 Monetary Policy Statement, the country's economic landscape continued to face increased challenges and the economic slow-down experienced was magnified by subdued external demand, coupled with a deterioration in domestic macroeconomic conditions (Reserve Bank of Zimbabwe, 2015). The economic problems made it difficult for academics and students to take advantage of the internet and benefit from the available resources on the web (Mavodza, 2014; Mugwisi, 2015).

1.3 RESEARCH PROBLEM

Availability of e-resources at academic and research institutions continue to increase and ways for accessing the resources keep changing. As discussed in the above sections it became clear that despite many attempts to provide low cost and free e-resources to developing countries they are poorly used and a variety of factors as reflected in the literature have been reported. Research on challenges of users access, use and interaction with available e-resources at tertiary institutions is needed and the problems are worth investigating. This study investigated the challenges encountered when using e-resources by information specialists, academic staff and postgraduate students involved with Scientific, Technological and Medical (STM) disciplines at universities in Zimbabwe. The focus was on low-cost and free e-resources.

1.4 PURPOSE OF THE STUDY

The purpose of this study was to investigate the problem of factors affecting the use and non-use of free and low-cost library e-resources by information specialists, academic staff and postgraduate students in the scientific, technological and medical (STM) disciplines at universities in Zimbabwe with the intention to recommend policy and guidelines to promote the use of these e-resources and for the improvement of information literacy training to support the use of these databases at the universities.

1.5 OBJECTIVES OF THE STUDY

This study is aimed at contributing to the body of knowledge on the following:

- Establishing what factors are causing the use and non-use of free e-resources by STM disciplines' academic staff, postgraduate students and information specialists at universities in Zimbabwe; and
- To recommend policy and guidelines to promote the use of these e-resources for the improvement of information literacy training to support the use of these databases at the universities.

The study therefore assesses access to and use of free and low-cost e-resources such as HINARI, AGORA, TEEAL and DOAJ by STM disciplines' academic staff, postgraduate students and information specialists at selected universities in Zimbabwe, and makes recommendations to promote the use of free and low-cost e-resources at the universities, as well as in other developing countries. The latter is the overall aim of this study.

1.6 RESEARCH QUESTION AND SUB-QUESTIONS

The factors causing low use or non-use of the free e-resources in Africa must be established if use is to be improved. This study is therefore aimed at answering the question:

> What are the factors affecting the effective use and non-use of free and low-cost e-resources by academic staff, postgraduate students and information specialists in the scientific, technological and medical disciplines at universities in Zimbabwe?

The following sub-questions were investigated in order to establish the factors:

i. What is the *status quo* of free and low-cost e-resources available at universities in Zimbabwe?
ii. What has been reported about the use of free and low-cost e-resources and information behaviour in this regard, especially concerning developing countries?
iii. What has been reported on the improvement and encouragement of the use of free and low-cost e-resources in developing countries?
iv. Which factors are influencing academic staff, postgraduate students and information specialists' *access* to e-resources in STM disciplines at universities in Zimbabwe?
v. Which factors are influencing academic staff, postgraduate students and information specialists' *use* of e-resources in STM disciplines at universities in Zimbabwe?
vi. How can the use of e-resources at universities in Zimbabwe be effectively promoted in order to increase the use of these resources by academic staff and information specialists at these universities?

1.7 RESEARCH METHODOLOGY

1.7.1 Research design

A descriptive survey was used in this study. Descriptive designs result in a description of the data, whether in words, pictures, charts or tables. The data analysis can show statistical relationships or it can be merely descriptive. The type of description that results from this design depends on how much information the researcher has about the topic prior to data collection. An in-depth literature study of the topic was undertaken before the data collection. Although absolute proof of causality cannot be established in a descriptive survey, it is possible to accumulate extensive evidence to support causality. (NetTOM – Center to Bridge the Digital Divide (CBDD) – Washington State University, 2008:53).

In addition, inferential statistics were used. As stated by Trochim (2006), by using inferential statistics, one is trying to reach conclusions that extend beyond the immediate data alone. For instance, inferential statistics are used in an attempt to infer from the sample data what the population might think.

An in-depth literature study was conducted, and a survey to identify the factors for use and non-use of free and low-cost e-resources at the selected universities. Questionnaires were used to collect data administered through visits to the five universities. Questionnaires completed by the identified STM academic staff, postgraduate students and information specialists were collected during these visits.

1.7.2 Study sites and target population

There are 14 public and private universities in Zimbabwe. Seven run postgraduate degree programmes; five of these are public and two are privately owned. Of these, five have post-graduate programmes in the STM fields. The study was conducted at five universities, i.e.:

i) Africa University (AU)
ii) Chinhoyi University of Technology (CUT)
iii) Midlands State University (MSU)
iv) National University of Science and Technology (NUST)
v) University of Zimbabwe (UZ).

The target population for this study was academic staff and postgraduate students enrolled in the STM disciplines, directors of the libraries and information specialists responsible for e-resources in the university libraries. According to the World of Learning (www.worldoflearning.com), the student population at the five universities in total was about 30 000 in 2013. STM schools or faculties had about 700 postgraduate students, 150 academic staff and 145 information specialists distributed as indicated in Table 1.2.

Table 1.2: Selected universities: distribution of students, academic staff and information specialists[4]

University	Student population*	Faculties and schools of STM disciplines*		
		Academic staff (STM)	Postgraduate students (STM)	Information specialists
UZ	12 466	70	435	55
NUST	4 781	45	167	20
CUT	1 885	8	26	15
AU	1 200	15	60	30
MSU	10 387	14	46	25
		152	**734**	**145**

[4] Sources: SARUA (2013), World of Learning, 2013 (www.worldoflearing.org); Agricultural Education Training in Africa Portal, 2014 (www.aet-africa.org).

1.7.3 Sample and sampling procedures

Purposive sampling was used to select participating faculties, as STM e-resources mainly cover the agriculture, health or medicine, environmental and technology disciplines. According to Miles and Huberman (1994:27), "purposive sampling permits the selection of subjects whose qualities or experiences permit an understanding of the phenomena in question, and are therefore valuable; this is the strength of purposive sampling." They argue that it is also appropriate for qualitative research with small samples. Ritchie *et al.* (2013) confirms this.

1.7.4 Data and data-collection techniques

Questionnaires were used to collect primary data. The questionnaires were administered to the academic staff, postgraduate students and information specialists by visiting the academic staff in their offices, the students in their classes and the information specialists in their libraries. Heads of the academic libraries at the five universities were also surveyed.

1.8 SIGNIFICANCE OF THE STUDY

The study aims to establish the problems influencing the use of e-resources by academics at tertiary insitutions and make recommendations to policy at the institution in order to improve the use of the resources at the institutions. This research adds to the body of knowledge on the access, use and interactions of users with e-resources with special focus on low-cost and free e-resources.

1.9 DEMARCATION OF THE STUDY

This study is limited to establishing the factors determining use and non-use of free and discounted e-resources by academic staff and postgraduate students involved with the STM disciplines and information specialists involved with e-resources at five selected universities in Zimbabwe. Although the study results will hold value for other developing countries, there may be some differences as well.

1.10 CLARIFICATION OF KEY TERMS AND CONCEPTS

The working definitions of terms and concepts below are used in this study.

1.10.1 Developing countries

A developing country, also called a less-developed country, is a nation with a lower living standard, underdeveloped industrial base, and low human development index relative to other countries. Developing countries are defined according to their GNI per capita per year. Countries with a GNI of $11 905 and less are defined as developing (World Bank, 2012). The majority of Sub-Sahara African countries are in this category.

1.10.2 Countries in transition

These are countries with a transitional economy, one that is changing from a centrally planned economy to a free market. Transitional economies undergo economic liberalisation, where market forces rather than a central planning organisation set prices (World Bank, 2012; UNCTAD, 2015).

1.10.3 Developed countries

A developed country, industrialised country, or "more developed country" is one that has a highly developed economy and advanced technological infrastructure relative to other, less industrialised nations. The countries have a high GNI of over $12 616 (World Bank, 2012).

1.10.4 Digital library

The term "digital library" refers to a compilation of electronic versions of published literature, including books, journals, etc (Fox & Urs, 2002:505). According to *Online Dictionary of Library and Information Science* (2013), a digital library is one in which a significant proportion of the resources are available in digital (machine-readable) format, as opposed to print or microform. Digital libraries are also referred to as e-resources (Fox & Urs, 2002:505). E-resources include bibliographic databases, electronic reference books, e-journals, search engines for full-text collections, digital collections of data and data sets. According to Seadle and Greifeneder (2007:170), a digital library or electronic library is a collection of services and information objects that support users in dealing with information objects available directly or indirectly via electronic or digital means.

Although the terms "electronic" and "digital" can be used interchangeably, this study consistently uses "electronic" to describe information accessed online or through local networked resources.

1.10.5 Electronic journals

As defined by Mark Ware Consulting (2006:12), e-journals are a version of a hard copy published peer-reviewed journal delivered electronically. Electronic journal databases are collections of several e-journals, which are at times referred to as journal gateways or journal collections, such as the AGORA and HINARI databases. The term peer review is a quality-control and certification filter necessitated by the vast scale of learned research available (Harnad, 1999).

1.10.6 Bibliographic database

The term "bibliographic database" refers to a database of bibliographic records. It provides a descriptive record of an item, but the item itself is not provided in the database. Information about the item is provided, including author, title, subject, publisher, etc. The information provided is called a citation. Sometimes a short summary or abstract of the item is provided as well. Examples of bibliographic databases include the GALILEO database, Social Sciences Abstracts, or the Internet Movie Database on the World Wide Web (WWW) (Online Learning Library Center, 2015).

1.10.7 Open access

Access to e-journals can be free, fee-based or through open access. Free journal articles are provided free of charge, while some payment is required from users for fee-based journals. Open access is the right of users to "read, download, copy, distribute, print, search, or link to the full texts of these articles" (Suber, 2015). For the purposes of this study, open access journals are defined as journals that use a funding model and does not charge readers or their institutions for access. Open access implies broader access without institutional or technical constraints (Drott, 2006:79; Suber, 2015). Allen and Weber (2014), Melero *et al.* (2014) and Di Salvo *et al.* (2015) make the same point.

1.10.8 Open educational resources

The term "open educational resources" (OER) is used in this study as defined by UNESCO (2002), as "technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes."

1.10.9 Postgraduate students

The term "postgraduate student" refers to students enrolled for master's or doctoral studies at the universities. Although postgraduate studies can include honours programmes, they are excluded from this study.

1.11 DIVISION OF CHAPTERS

Chapter 1 provides an introduction and overview of the background of the research question and puts into context the focus of the study. It covers the research question, sub-questions, clarification of concepts and brief reviews of the literature and the research methodology, as well as the scope of the following chapters.

Chapters 2 and 3 cover the literature review. A definition and a brief history of e-resources are offered. The electronic information behaviour of users is covered, and an analysis of published studies on the use of e-resources.

Chapter 4 covers the research methodology of the study. The research design, the sample and sampling procedure are discussed. Data and data collection techniques are outlined.

Data analysis and findings of the study are presented and discussed in **Chapter 5**. The chapter covers the key findings of the study and highlight the contributions to the existing body of knowledge on the subject. Strategies to address the identified problems are discussed.

Chapter 6 deals with inferential statistics. It discusses the findings of levels of significance of factors on the use of e-resources by using the general linear model (GLM) procedure. The chapter presents the results of factor analysis as a means to identify factors that may influence information specialists, academic staff and students in the use of e-resources.

In the last chapter (**Chapter 7)** the findings are summarised and evaluated against the original problem statement and research objectives. The chapter includes a conclusion, recommendations and suggestions for further research.

1.12 SUMMARY

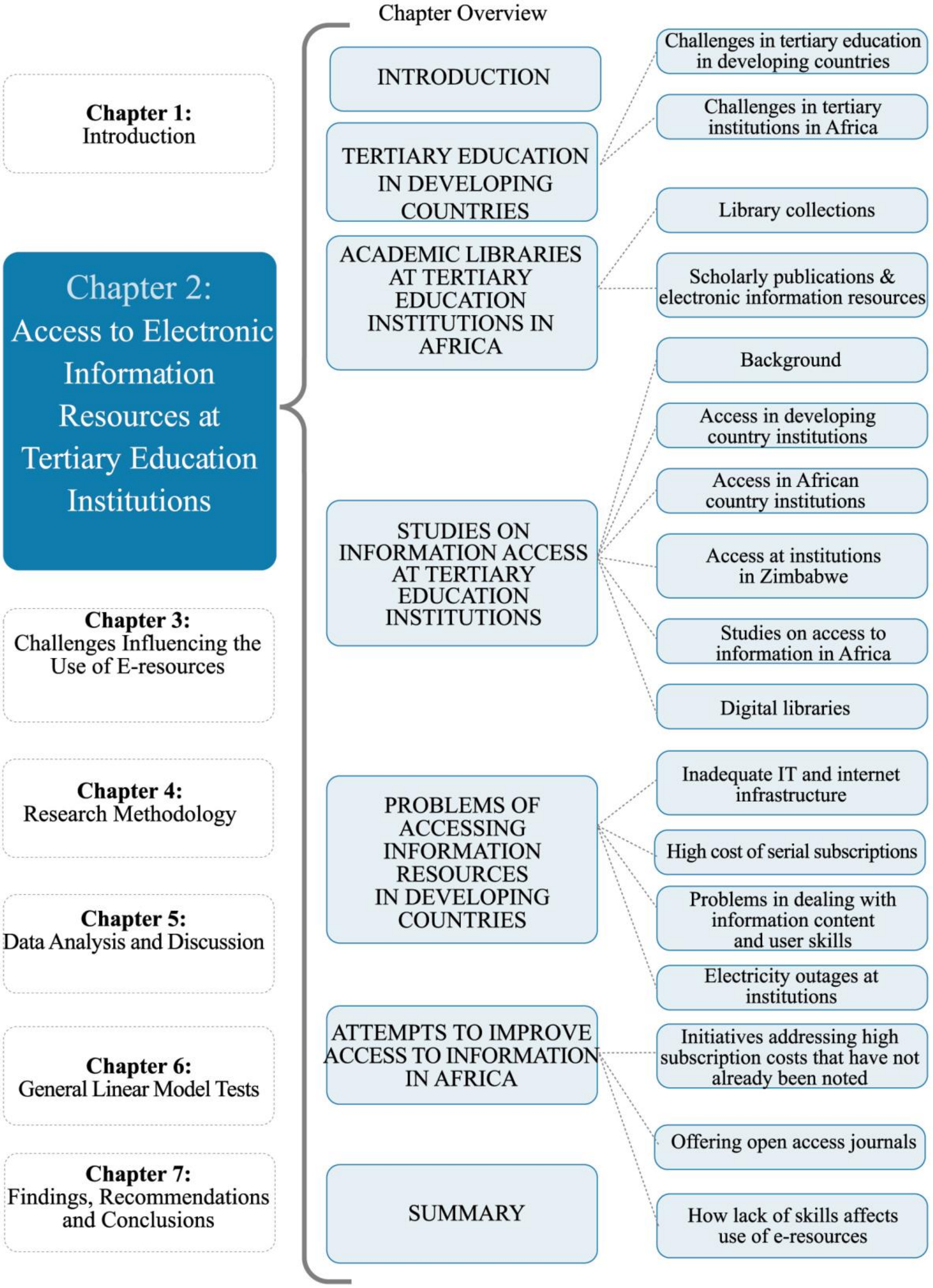
Access to up-to-date scholarly literature needs to be improved if research and development is to improve in Africa. Some libraries in developing countries, particularly in Africa, find it difficult to access and keep their collections up to date. This chapter highlights the importance of e-resources and the role they play at tertiary institutions. It explains the problem statement, the research question and sub-questions, study objectives and knowledge gap it addresses and the significance of the study. It covers the demarcation of the study and clarifies key terms and concepts used in the study.

Efforts undertaken in recent years to reduce the gap in access to e-resources between developing countries and developed countries through initiatives such as Research4Life and PERI are introduced. Problems reported to affect the access and use of available e-resources in developing countries including limited library budgets, limited ICT and internet infrastructure issues and lack of e-resources user skills are highlighted.

The chapter closes by outlining the division of chapters in the rest of the thesis.

CHAPTER TWO: ACCESS TO ELECTRONIC INFORMATION RESOURCES AT TERTIARY EDUCATION INSTITUTIONS

Chapter Overview



2.1 INTRODUCTION

As indicated in Chapter 1, this study is aimed at answering the research question - what are the factors affecting the effective use of free and low-cost e-resources by academic staff, postgraduate students and information specialists in the scientific, technological and medical disciplines at universities in Zimbabwe?

Also as hinted in Chapter 1, many factors influence the use of e-resources at universities; access to such resources is especially important (Ajiboye & Bankole, 2013; Bhat & Mudhol, 2014; Kumar & Reddy, 2016). This chapter seeks to establish the status of e-resources available in tertiary education institutions in developing countries and especially in Africa. More specifically, it focuses on what has been reported about access, problems with access, attempts to solve the problems, and especially the effective use of free and low-cost e-resources in tertiary institutions. Although acknowledging reports from an international spectrum, the emphasis is on developing countries, especially Africa. Other factors influencing the use of scholarly e-resources, such as inadequate user skills, lack of culture of doing research, and the net generation effect are dealt with in Chapter 3.

To put the problem of access to e-resources and the use of resources in context, this chapter starts by stressing the importance of tertiary education in developing countries and the important role academic libraries associated with tertiary education institutions play. The strengths of and concerns about electronic library resources in African academic libraries are briefly highlighted.

Studies conducted on access to information at tertiary education institutions in developing countries are reviewed with special focus on studies in Africa, and access to scholarly publications which, as explained in Chapter 1, can be available as e-resources, and may include e-journals, e-books and video materials. To put this in context, a distinction is drawn between developing and developed countries, with a brief reference to studies on access to information in the later chapters. Studies on African institutions are dealt with in detail, with reference made to specific types of e-resources and the different ways to access specifically e-journals. As discussed in Chapter 1, reference to e-resources by researchers is key in the development of new knowledge. Studies focusing on problems experienced with access to e-resources at tertiary institutions in developing countries are then discussed. To put this in context, studies of developed countries are also briefly mentioned.

The chapter ends by highlighting attempts to improve access to e-resources at tertiary institutions in Africa, again with a brief reference to developed countries. Other factors, apart from access, influencing the use and non-use of e-resources will be dealt with in detail in Chapter 3. Chapter 3 focuses on the impact of different disciplines on use of e-resources and the level of technology adoption by different user groups, as well as findings on information-seeking behaviour and user preferences for e-resources at academic institutions. This study started in 2009. Literature around the time, as well as more recent studies, is thus analysed in this chapter and the next.

2.2 TERTIARY EDUCATION IN DEVELOPING COUNTRIES

Tertiary education is more than the capstone of the traditional education pyramid − it is a critical pillar of human development worldwide (World Bank Report, 2002; Salmi, 2003; Materu, 2007). No doubt, the development of tertiary education is critical both in developed and developing countries. It can play a catalytic role in helping developing and transitional countries rise to the challenges of the knowledge economy. A strong correlation exists between participation in tertiary education and the level of economic development of nations (Mikhail, 2008; Fisher & Scott, 2011; Spaull, 2013). The terms “developing country” and “transitional country” are explained in section 1.8 in Chapter 1.

Tertiary education is vital to the growth of any country, and developing countries have been investing in tertiary education for decades (Altbach & Salmi, 2011; Fisher & Scott, 2011; Spaull, 2013). Universities are clearly a key part of tertiary education. The diverse and growing set of public and private tertiary institutions in every country, including colleges, technical training institutes, community colleges, nursing schools, research laboratories, centres of excellence, distance learning centres, and many more in addition to universities, forms a network of institutions that, according to the World Bank Report of 2002, support the production of higher-order capacity necessary for development (World Bank Report, 2002; Salmi, 2003; Michail, 2008; Fisher & Scott, 2011).

All over the world tertiary institutions face challenges such as overcrowding due to increased student enrolment, inadequate funding leading to inadequate facilities, and overloaded faculty resulting in production of low quality graduates (Sawyerr, 2004a; Teferra & Altbach, 2004; Juma, 2005; Gioan, 2006; Materu, 2007; Thiaw, 2007; Tilak, 2011; Spaull, 2013). Concerns about tertiary education also apply to Southern Africa (SARUA, 2013; Spaull, 2013). In Zimbabwe, tertiary education has not been spared the economic downturn during the past few years (Government of Zimbabwe, 2008; Musarurwa, 2011; Chikwanha, 2014; Mugwisi, 2015).

Tertiary education in Zimbabwe is about eighty-five years old, having started with the Polytechnics of Bulawayo and Harare, both founded in 1927 (Darko-Ampem, 2005). It has expanded rapidly since 1980 (Musarurwa, 2011). As discussed in Chapter 1, there are 14 universities operating in the country, with over 60 000 students (AET Africa Portal, 2014) (www.aet-africa.org). Problems of overcrowding, inadequate infrastructure such as laboratories, library and ICT facilities (Mbambo, 2001; Government of Zimbabwe, 2008; Chikwanha, 2014) and lack of access to up-to-date international research knowledge (Mbambo, 2006; Zanamwe, Rupere & Kufandirimbwa, 2013; Malapela & De Jager, 2015) have been reported at these universities. These problems are explored in more detail in the next chapter.

2.2.1 Challenges in tertiary education in developing countries

According to the World Bank's 2002 report, aptly titled *Constructing Knowledge Societies: New Challenges for Tertiary Education*, problems of quality and lack of resources are compounded by the new realities faced by higher education, as higher education institutions battle to cope with ever-increasing student numbers. These problems are more pronounced in developing countries. The report indicates that among these unresolved challenges are the need to expand tertiary education coverage in a sustainable way, inequalities of access and outcomes, problems of educational quality and relevance, and rigid governance structures and management practices.

Cooksey, Levy and Mkude (2003), Teferra and Altbach (2004), Kapur and Crowley (2008) and Mahgoub and Alawad (2014) all offer similar arguments about African higher education institutions and highlight the problem of insufficient and sometimes declining funding, which is often compounded by the inefficient use of available resources.

Reports and papers by Sawyerr (2004a), Teferra and Altbach (2004), Juma (2005), Thiaw (2007), Kapur and Crowley (2008) and Mahgoub and Alawad (2014) also point to the problems of (i) failing to keep curricula updated in order to meet the needs of local industries (Sawyerr, 2004a), and (ii) research that does not succeed in addressing the problems of local communities (Juma, 2005), and (iii) academic staff at postgraduate level who are generally overloaded with teaching, and the difficulty of balancing research and teaching (Thiaw, 2007; Kapur & Crowley, 2008; Cloete, Bailey & Pillay, 2011; Oyewo & Bello, 2014; Ukachi, Onuoha & Nwachukwu, 2014; Dulle, 2015).

Some of these serious problems are common to tertiary education institutions in many African countries; they are often intense and are exacerbated by lack of funds (Cooksey, Levy & Mkude, 2003; Teferra & Altbach, 2004; Manuh, Gariba & Budu, 2007; Shabani, 2007; Thiaw, 2007; Mahgoub & Alawad, 2014).

In addition to what has been reported on developing countries, there have also been a number of reports on problems experienced specifically in Africa. The next section briefly explores what has been published, in order to contextualise the discussion of problems experienced with regard to e-resources.

2.2.2 Challenges at tertiary institutions in Africa

Like other universities around the world, African universities are key institutions for the production, preservation and dissemination of knowledge for the advancement and betterment of humanity (Gravenir, 2004; Materu, 2007; Spaull, 2013).

Although African countries are diverse and at different levels economically, there are similarities across countries in respect of some problems that have been studied and reported in higher education institutions in recent years (Mahgoub & Alawad, 2014). For instance, common problems have been reported in the Anglophone region in Malawi, Kenya, Tanzania, Uganda, Zambia and Zimbabwe in studies by Teferra and Altbach (2004), Juma (2005), Thiaw (2007), Kapur and Crowley (2008), Mahgoub and Alawad (2014) and Dulle (2015). Universities were established either immediately before or within a decade after political independence in most African countries (Thiaw, 2007; Shabani, 2008; Shabani, Okebukola & Oyewole, 2014). With the relative decline of state support during the severe economic crisis of the 1980s, these countries' universities suffered substantial deterioration: overcrowding, infrastructure deficiency and inadequate access to international knowledge resources (Sawyerr, 2004b; Materu, 2007; Shabani, 2008).

Important issues have been reported with regards to funding, overcrowding problems and quality assurance.

2.2.2.1 Funding problems

Inadequate funding poses many problems at most universities, especially at many state-funded institutions. This is a result of declining state financial support. Lack of adequate funding at higher education level reported in Malawi, Zambia and Zimbabwe (Materu, 2007; Chikwanha, 2014; Mugwisi, 2015) is a major issue with which Central and Southern African countries' higher education institutions continue to grapple. This problem is exacerbated by the increased demand for higher education – a common problem in Southern African countries (CODESRIA, 2006; Shabani, 2008; SARUA, 2013; Chikwanha, 2014; Mahgoub & Alawad, 2014).

Furthermore, sources of funding for African universities are too often externally generated (Juma, 2005; Materu, 2007; Fisher & Scott, 2011). The funders consequently define priorities and fix the goals and the means to achieve them.

i) External funding is used to supplement and cover projects and at times overheads such as faculty and staff salaries. Many universities in Zimbabwe, Zambia and Malawi focus on income-generating projects in order to increase income (Materu, 2007; Shabani, 2008; SARUA, 2013; Chikwanha, 2014; Shabani & Okebukola, 2014).

ii) External funders influence research agendas and focus at many universities and these agendas may not be in line with the needs of the university and local community (Juma, 2005).

iii) Another sad fact about universities in Africa is that scholars in Africa are generally more tuned to research, technical and theoretical innovations, and publications originating from Europe and North America than from their immediate African neighbours (Thiaw, 2007; Shabani, 2008; Ndungu, 2016).

2.2.2.2 Overcrowding problems

Dealing with the extremely high student enrolment and ageing faculty that requires renewal are major challenges (Thiaw, 2007). According to Gioan (2006) and Shabani (2008), African tertiary institutions are faced with the difficulties of effecting adequate pedagogical, organisational, administrative, financial and institutional reforms to meet increasing student enrolment and the needs of industry. No doubt these problems are country-specific, as Thiaw (2007) and Shabani (2008) argue.

i) **Administrative and quality issues**

Dwindling state support at Zimbabwean public universities in the past two decades has caused major administrative problems, with increased student intakes leading to overcrowding and burdening of the available facilities (Government of Zimbabwe, 2008b; Tshuma, *et al.*, 2015). Graduates produced are of low quality and do not meet the requirements of the community and labour market (Government of Zimbabwe, 2008b; Mavodza, 2014; Tshuma, *et al.*, 2015).

ii) **Inadequate infrastructure and resource problems**

Infrastructure and resources to meet the growing student numbers at higher education institutions are inadequate. There are insufficient facilities such as libraries, lecture rooms, computers, internet and science laboratories, instruction technologies, etc to meet the increased demand, especially at state-funded public institutions (Gioan, 2006; Thiaw, 2007; Shabani, 2008; Oyewo & Bello, 2014).

Inadequate library collections and limited access to international up-to-date scholarly publications through journals, books and access to relevant databases hamper teaching, learning and research (Chikwanha, 2014; Dulle, 2015).

2.2.2.3. Quality assurance problems

Issues of quality assurance have become a common feature in reports of higher education evaluation, given its importance (Mahgoub & Alawad, 2014). The main shortcomings are:

i) **Outdated curricula**

Universities have been reported to use outdated curricula, pedagogical approaches and courses that have not been updated and aligned with the requirements of the local communities and industry (Sawyerr, 2004a; Juma, 2005). For curriculum change to have any significant impact, they must be accompanied by adequate research "infrastructures, including laboratories, equipment, libraries, an effective system to store, retrieve and exploit information database, systems to encourage, evaluate and reward high calibre research, etc" (Sawyerr, 2004a: 222).

ii) **Teaching overload**

Academic staff overloaded by teaching duties have too little time for research (Juma, 2005). For instance, classes of 400 to 1 000 students in Malawian, Zambian and Zimbabwean universities are reported, especially in lower level degree courses. The burden this places on the limited number of academic staff employed in the institutions affects the quality of graduates (Juma, 2005; Shabani, 2007; Mahgoub & Alawad, 2014).

iii) **Brain-drain**

The best faculty members and students leave for overseas universities, seeking quality research, higher pay and education. Stopping educated academic staff from leaving African universities for overseas jobs is a problem. Thiaw (2007) argues that many African countries spend billions to educate a mass of students who end up either in foreign countries or unemployed. In these circumstances, higher education appears to be an investment loss in many African countries. To address such issues and achieve a country's objectives, a country such as Senegal has decided to put 40% of its national budget into education (Juma, 2005). Thiaw (2007) argues that although this kind of investment may sound considerable, it seems that the crisis in Senegalese universities and in the school system in the country is more intense than ever, as most of the money is diverted toward salaries and other social charges rather than research, curriculum and pedagogical reforms. As argued by Shabani (2008), the challenges in Sub-Saharan African higher education have not changed.

iv) **Low research output**

In many universities publication capacity is poor and research infrastructure is too often obsolete, inadequate or simply non-existent. Reports cite low research output and manuscripts that cannot make it into international peer-reviewed publications. There are problems with low-quality research, non-competitive research output and publications from academic staff that do not meet international standards (Olukoju, 2004; Materu, 2007; Thiaw, 2007; Fisher & Scott, 2011; Nelson & Huffman, 2015).

For instance, Baker (2008) points out the significance and value of publishing research journals in South Africa. He notes however that young researchers in the country submit poorly presented papers, though their scientific results are publishable. Baker argues that this problem can be addressed if the journal editorial office should assist in erasing the gap between unsatisfactory initial submissions and final articles in polished, published form.

v) Replacement of ageing academic staff

According to Sawyerr (2004a), the problem of replacing ageing academic staff by young faculty members in specific focus areas has been reported in many African universities. Examples at the time were Sokoine University of Agriculture in Tanzania and the University of Zimbabwe in Zimbabwe.

vi) **Low completion rates**

Students' low completion rates at many African universities is a notable challenge in higher education (Mahgoub & Alawad, 2014). An example is the increased student dropout rates in South African tertiary institutions (Fisher & Scott, 2011; SARUA, 2013). A Student Pathways study by the Human Sciences Research Council undertaken in 2007 found that on average only 15% of students finished their degrees in the allotted time (Macgregor, 2007; Letseka & Maile, 2008).

A similar study in 2015 by the Zimbabwe Council for Higher Education of six state universities found that the university graduation rates decreased from 86% in a 2009 cohort, to 76% in a 2010 cohort and 75% in a 2011 cohort (Garwe & Maganga, 2015).

Overall, as rightly argued by Juma (2005) and supported by SARUA (2013), curriculum change, focused on community issues, will require prior quality research, publications, a lighter teaching load, decent earnings, and re-evaluation of the higher education system to deal with the academic problems at higher education institutions in Africa.

2.2.2.4. Access to up-to-date international knowledge

Apart from the above problems, the challenges mentioned below are especially relevant for the purpose of this study. Access to scholarly publications at universities in the region remains a problem (Khabsa & Giles, 2014). This affects the ability to produce and access scholarly publications (Mavodza, 2014; Dulle, 2015). The key issues are access to scholarly publications, which is essential for the quality of curriculum content, research and publishing; opportunities to participate in scholarly publishing; and opportunities to incorporate scholarly publications as part of virtual learning environments (Khabsa & Giles, 2014; Mugwisi, Ocholla & Mostert, 2014; Joseph, 2015). The following section discusses these key issues:

i) Access to up-to-date study material

As alluded to earlier in this chapter, the unavailability of relevant up-to-date study material for faculty and students, inadequate facilities (such as libraries, computers and laboratories for science courses, etc) and inadequate scholarly publications from the universities make it difficult for the quality of tertiary education offered in Africa to compete with that offered in the developed world (World Bank Report, 2002; Kapur & Crowley, 2008; Dulle, 2015; Ostergaard, 2015). Scholarly communication, in particular, is affected by these inadequacies. Because of its importance in promoting excellence in tertiary contexts, scholarly communication is discussed in more detail in the following section.

ii) Scholarly communication

Scholarly publishing is a means of communicating scholarship in a community. According to Shoham (1998) and Halliday (2001), scholarly communication focuses on the creation of new knowledge through research and scholarship and the subsequent submission of findings to a journal in a relevant discipline. As Ostergaard (2015) asserts, rigorous peer review ensures that the contribution meets minimum standards. Publication and dissemination (usually through library subscriptions) makes the new knowledge available to the next community of researchers who will build further on it (Shoham, 1998; Halliday, 2001). Such content is made available through various means, such as commercial journals, books and technical reports. In addition, many universities in the developed world are digitising their libraries, providing an essential but extremely expensive part of tertiary education to universities in developing countries. Shoham (1998), Goodrum *et al*. (2001), Kapur and Crowley (2008) and Ostergaard (2015) support this view and add that the web has provided a new communication channel for publication of scholarly research and the dissemination of informal research discussion. Harle (2010) and Egle *et al*, (2015) assert that many academic institutions in Africa have taken advantage of web development and are increasingly providing access through online library e-resources as a way to improve access to scholarly literature.

iii) Emergence of digital resources

Since the late 1990s there has been a dramatic expansion of scholarly resources available online, specifically through the use of "open courseware", in which high-quality "open knowledge" materials, including course content, library collections, and research data, are made available. The Massachusetts Institute of Technology pioneered this movement in 2001 when it announced plans to put material for almost all of its courses online (Kapur & Crowley, 2008). Now, thousands of complete degree course modules and scholarly publications are freely available online through open education resources (OER), shared through learning object repositories and databases that anyone can make use of (Secker, 2004; Kapur &

Crowley, 2008; Griffiths, *et al.*, 2014; Clements, Pawlowski & Manouselis, 2015; Di Salvo *et al.*, 2015; Seymour-Green, 2016).

According to Rosenberg (2008) and Di Salvo *et al.* (2015), tertiary institutions in Africa are benefiting in terms of access through these initiatives. This access is contributing to improved quality of curriculum content, research and publishing at universities by opening up access to scholarly materials to which researchers in African countries had no access before the coming of online e-resources (Oaister, 2009; Harle, 2010; Pawlowski & Clements, 2013; Clements, Pawlowski & Manouselis, 2015).

iv) Opportunities in virtual learning environments

Abundant opportunities have been brought about by the coming of the digital era in publishing in the past few decades. Users can access digital libraries across the internet at any time without the restrictions of library opening hours. In most developed countries scholarly publications are part of the virtual learning environment created over the web. Institutional repositories, digital libraries and e-journal collections and databases make up extensive virtual learning environments (Bearman, 2007; Sharma, Singh & Sharma, 2011; Sharma, 2013; Ifijeh, 2014; Erb & Erb, 2015; Seymour-Green, 2016). However, in developing countries, opportunities to incorporate scholarly publications as part of virtual learning environments are often limited by limited access and barriers to the internet (Andersson & Grönlund, 2009; Akporhonor & Akpojotor, 2016) and the low usage of e-resources at academic institutions (Pawlowski & Clements, 2013; Clements, *et al.*, 2015; Akussah, 2015).

Cullen and Chawner (2009), Tripathi and Kumar (2014) and Kumar and Reddy (2016) assert that academic libraries are a key part of the scholarly communication cycle. With improved libraries and use of scholarly literature, African scholars have a better chance of improving their research outputs and to compete at the same level with their colleagues at universities in developed countries. Ocholla (2011) argues that the digitisation of research publications and electronic publications has made scholarly communication exceedingly versatile, accessible, effective and efficient.

In Zimbabwe, universities are taking advantage of access to digital scholarly communication, although the problems of limited ICT and internet infrastructure and inadequate user skills seem to hinder this access (Chikwanha, 2014; Malapela & De Jager, 2015). Many of these issues feature in more detail in the sections to follow.

2.3 ACADEMIC LIBRARIES AT TERTIARY EDUCATION INSTITUTIONS IN AFRICA

As noted, libraries play a critical role at tertiary institutions. As Rosenberg (2005) notes, good libraries are a critical part of any university's research and teaching, whether in physical or digital form. This assertion is supported by Kavulya (2007), Musoke and Kinengyere (2008), Harle (2010) and Tripathi and Kumar (2014).

Academic libraries in Africa, however, face many challenges, including inadequate budgets, limited personnel skills, especially regarding ICTs and e-resource access, insufficient collections, lack of facilities such as computers and the internet, and insufficient access to international knowledge resources. These problems are exacerbated by the continued decline in library budgets, as libraries have to compete for limited resources at the institutions (World Bank Report, 2002; INASP, 2005; Rosenberg, 2005; Harle, 2010; Horstmann, Ahn & Schmidt, 2015).

In Africa most academic libraries lack adequate collections to meet the needs of their users (Kapur & Crowley, 2008). Books and serials, as has been experienced internationally, have become expensive and many African universities do not have adequate library budgets to acquire the required library collections for the programmes offered (Rosenberg, 1998). For example, according to the 1999 United Nations Human Development Report (UNDP, 1999), whereas a USA medical library subscribes to about 5 000 journals, the Nairobi University Medical School Library, long regarded as a flagship centre in East Africa, in 1998 received only 20 journals (compared with 300 a decade before). In Brazzaville, Congo, the university had only 40 medical books in its 1999 collection and a dozen journals, all from before 1993 (Witten, 2000).

In 2013 Research4Life provided free access to its offering of information resources of 35 000 scholarly resources comprising13 000 journals and over 22 000 e-books (Research4life, 2013), which should address the issue of access. By December 2015 the number had grown to 68 000 journals and e-books (Table 1.1) and yet the growth in use remained subdued (Gaible, 2015).

No doubt, insufficient collections severely constrain research (Harle, 2010). Harle (2010) asserts that many African libraries have struggled to maintain good collections in the face of falling budgets, rising purchasing costs and expanding student numbers. The situation in some universities in Sub-Saharan Africa outside South Arica is dire.

In Zimbabwe, the academic libraries' situation is not any different from that of most other universities in Africa. According to Malapela (2014), during the economic downturn in the country from 1999 to 2014, many library collections were not updated adequately. Many users at universities thus rely on freely accessible online e-resources such as e-journals and e-books for their research, teaching and learning, as set out in the problem statement for this study (section 4.2) and as reflected in Table 1.1. The question, however, arises why they seem not to be fully exploiting such sources. This aspect is addressed in subsequent sections.

2.3.1 Library collections

Library collection size defines the information and knowledge level contained in any library (Slote, 1997; Tripathi & Kumar, 2014). At the same time, and as rightly argued by Slote (1997), the number of books in a library should not be the criterion for the measure of the quality of a library. Slote (1997) and Tripathi and Kumar (2014) argue that the currency and relevance of the materials are key in evaluating the importance of the collection. Digital library collections have emerged in the past two decades to complement the print collections, particularly at educational institutions (Tenipor & King, 2000; Sharma, 2013; Jotwani, 2014; Tripathi & Kumar, 2014). Digital collections, as explained in sections 1.4 to 1.8, add a new dimension to library collections.

An academic institution library has several options for accessing information in such collections. These are presented in Table 2.1, which focuses on print and digital format (acknowledging, however, the inclusion of other formats in library collections, as explained in sections 2.4.1-2.4.2).

Table 2.1 Options for access to library collections

Collections of scholarly publications in libraries in tertiary education institutions

Print libraries	Include books, serials, reports, theses, journals
Digital libraries	Include databases, e-journals, e-books, institutions repositories, audio and visual materials
Hybrid collections	Include a combination of print and electronic resources. An example is when a library subscribes for an e-journal in a deal in which a print copy of the same journal is also received
Audio and visual materials	Include CDs, tapes, videos, etc

As pointed out in sections 1.6 - 1.7, with the emergence of digital libraries in the mid-1990s universities and colleges have taken advantage of electronic resources to supplement their meagre library collections (Bearman, 2007; Gomez, 2010). This means universities do not need big storage spaces for book collections or to spend huge sums of money on the acquisition of hard copy materials. Even new institutions can ensure adequate coverage of materials required by their users by subscribing to electronic resources. However, as argued by Goud and Gomez (2010), digital libraries are not cheap to build and maintain: they need adequate computer infrastructure and appropriate human skills to sustain them, as discussed in Chapter 1. These skills are not always readily available at African institutions (Goud & Gomez, 2010). Rosenberg (2008) concurs. In addition, as stated by Borgman (2000) and Kumar and Reddy (2016), several other problems worthy of research lie at the intersection of scholarly communication processes and digital libraries. These include the ability of digital libraries to support the cycle of information seeking, using and creating information; the "social life" of documents; and electronic publishing. Such problems are considered in more detail in sections to follow.

As mentioned in section 2.3, there are often problems with inadequate and outdated collections at African tertiary institutions' libraries. The problem of inadequate and outdated library collections means that faculty and students at these institutions find it difficult to access quality instruction, courseware and research material (Kapur & Crowley, 2008). Delaney-Lehman (2001) concurs with this point and also notes that in the case of small academic libraries, it is more difficult to develop collections in some special areas.

An example of an inadequate library collection can be seen in the following cases. The University of Great Zimbabwe, which was established in 1999, has 8 000 volumes for a user population of 2 500, which is inadequate for its ten faculties (Chikwanha, 2014). There is heavy dependency on donations for collection development from external funders such as Book Aid International to try to improve the collection (Chikwanha, 2014). This can be seen in the report by Harle (2009). The library at the University of Nairobi, Kenya's top research institution, has some 600 000 print book and monograph volumes and about 60 000 print journal volumes, and serves about 36 000 students and 1 419 academic staff (Harle, 2009). However, a recent study of the Kenyan university system suggests that the library was originally built to house some 2.5 million volumes and to serve only 6 000 students (Harle, 2009). Similarly, the libraries at Moi and Kenyatta universities, with seating for 2 500, now serve over 10 000 and 12 000 students respectively (Teferra, 2003; Mwiria *et al*., 2007).

Scholarly journal prices are rising much faster than libraries' budgets, and this is a major concern for many authors, librarians and institutions, even in developed countries (Teferra, 2004; Oppenheim, 2008; Bauerlein *et al.*, 2010; Dhanavandan, 2014; Bosch & Henderson, 2015). These challenges greatly affect the size and quality of collections found at most tertiary institutions in Africa (Harle, 2009; Bauerlein *et al.*, 2010). Of course, as argued by Harle (2009), the diversity of institutions and their facilities and resources make it difficult to make valuable continental generalisations. The above examples are nevertheless illustrative of broad trends.

Scholarly communities have taken advantage of e-resources since the 1990s, particularly in communicating research outputs (Coughlin, Campbell & Jansen, 2016). As reported by the ARL, research outputs published electronically in conference proceedings, peer-reviewed journals and on the web continue to grow (Howard, 2008; Bosch & Henderson, 2015).

2.3.2 Scholarly publications and electronic information resources

As discussed in Chapter 1, scholarly publications need to be accredited and/or peer-reviewed and are traditionally found in journals. Mark Ware Consulting Ltd. (2006) states that the development of online electronic versions of journals has had a significant impact on researchers' access to the literature, and in many cases publishers have retrospectively digitised hard copy material. In recent years, e-journals have been in common use in scholarly communication (Kurata *et al.*, 2007; Amjad, Ahmed & Naeem, 2013; Egle, *et al.*, 2015) and scholars are learning to exploit the digital-era advances of speedy access to new work, the open access model and benefits of being part of a network or online community of scholars that e-journals offer. A study by Vakkari in 2008 at the University of Tampere, Finland, confirmed these points. Vakkari's study consisted of a nationwide web-based survey of the end-users of FinELib, the Finnish Electronic Library, at all universities in Finland (Vakkari, 2008). More recent studies by Amjad, Ahmed and Naeem (2013), Egle *et al.* (2015), Kowalsky (2015) and Coughlin, Campbell and Jansen (2016) reached similar conclusions.

The internet and related network technologies have had a great impact on scholarly communities (Zhang, 2001; Vakkari, 2008; Ng, 2009; Amjad, Ahmed & Naeem, 2013; Egle, *et al.*, 2015; Kowalsky, 2015). For instance, McDonald (2006) and Kowalsky (2015) argue that the increased accessibility of online journals have greatly improved the dissemination of scholarly information. These e-resources can be accessed at any time of day, from wherever the researcher is located, and remain at that location for simultaneous or future use. Multiple ICTs have been used to access and deliver information resources effectively (Ng, 2009; Association of Commonwealth Universities, 2011; Tripathi & Kumar, 2014; Egle, *et al*, 2015; Kowalsky, 2015; Chen & Du, 2016), which have brought about substantial changes in the past two decades. Computers, radios and hand-held devices, such as mobile phones, IPods and e-readers, play an important role in information access and sharing (Egle, *et al.*, 2015; Kowalsky, 2015).

According to Kling (2004), in the early 1990s much of the enthusiasm for the use of electronic media to enhance scholarly communication focused on e-journals, especially electronic-only, (pure) e-journals. Online journals are available in electronic format mostly via the WWW and usually only on a subscription basis. Although some journals have printed counterparts as well, for example *Nature,* there are journals such as *Reading Online* and *Information Research* that are available in electronic format only (Bothma *et al.*, 2009:86).

Access to such sources can be a problem. Several studies have been undertaken in the last two decades to establish the level of access and use of e-resources in many settings, including tertiary educational institutions (Pullinger, 1999; Ehikhamenor, 2003; Drott, 2006; Rosenberg, 2006; Amjad, Ahmed & Naeem, 2013; Tripathi & Kumar, 2014; Chang *et al.*, 2015; Egle, *et al.*, 2015; Kowalsky, 2015). For example, a study was commissioned by the Arcadia Fund (www.arcadiafund.org.uk) and undertaken by the Association of Commonwealth Universities (ACU) in 2009 on obstacles to accessing and using digital scholarly information in African universities. The focus was on four universities in East Africa. Though reports indicate an increase in the use of e-resources at tertiary institutions in developed countries, more studies in developing countries are needed to establish the level of access and use, especially by academic staff, information managers and students (Halliday, 2001; Fox & Urs, 2002; Rosenberg, 2008; Tripathi & Kumar, 2014; Dulle, 2015). Such studies are discussed in more detail in the next section.

2.4 STUDIES ON ACCESS TO INFORMATION AT TERTIARY EDUCATION INSTITUTIONS

Although some of the studies on access to information have been touched on in preceding sections, they are now considered in more detail.

Studies on access to information at tertiary education institutions indicate that access to and use of e-resources continue to grow (Harnad, 1996, 1992; Foo & Chennupati, 2000; Mahe, Andrys & Chartron, 2000; Kapur & Crowley, 2008; Amjad, Ahmed & Naeem, 2013; Prasannan, Gabbur & Haughton, 2014; Tripathi & Kumar, 2014; Denny, *et al*., 2015; Egle, *et al.*, 2015). Spurred on by issues such as convenience, low cost and wide access across campuses and communities of practice, the adoption of e-resources at tertiary institutions has been reported as a success story at these institutions (Liew, Foo & Chennupati, 2000; Kapur & Crowley, 2008; Denny, *et al*., 2015; Egle, *et al.*, 2015). However, concerns about the nature of information accessed, information retrieved, relevancy, limited user skills and available computer and internet infrastructure have been cited as major drawbacks to the adoption and use of e-resources at tertiary institutions (Liew, Foo & Chennupati, 2000; Keene, 2004; Fisher, *et al*., 2008; Evans & Baker, 2013; Denny, *et al*., 2015; Egle, *et al.*, 2015; Spiranec, Zorica & Kos, 2016). These problems are more pronounced in developing countries (Lwoga *et al.*, 2007; Ayoku & Okafor, 2015). There are significant differences between and within developing countries. Several authors indicate that these concerns vary significantly in terms of the type of information resources (digital libraries, databases, e-journals, e-books, etc) (Rosenberg, 1997; Liew, Foo & Chennupati, 2000; Tenopir *et al*., 2003; Ayoku & Okafor, 2015). In addition, several reports have highlighted access problems, such as limited access to computers, slow internet connections, expensive and inadequate bandwidth and varying levels of user skills and information-seeking behaviour (Lwoga *et al.*, 2007; Ayoku & Okafor, 2015). Although there is thus growth in access, many problems are also noted.

2.4.1 Background on access to e-resources at tertiary institutions

As background to the discussion of the studies on access to information at tertiary institutions, it is important to reiterate that access to published knowledge is key for continued development of research, teaching and learning at tertiary institutions worldwide. Most of the tertiary educational institutions in developed countries rely on collections made up of books and subscription-based serials for their scholarly publications (Mark Ware Consulting Ltd, 2006; Ayoku & Okafor, 2015). According to Colvin and Keene (2004), Das, Dutta and San (2009) and Kowalsky (2015), digital collections of mainly e-journals and e-books that make up the collections and subscription deals may imply online access to e-resources or hybrids.

The above-mentioned issues should be seen against the benefits and value of digital libraries. The digital library has expanded libraries' services immensely over the years (Kapur & Crowley, 2008; Ayoku & Okafor, 2015). This access can be made available to all members of the community served by the library around the clock and, in many cases, at any place in the world from which they have internet access. This is clearly an expansion of library services that, without e-resources, would be beyond the budget dreams of many libraries (Pons, *et al*., 2015). The collections covered can be as wide and as deep as required: for example the *Lancet* journal has a run of over 150 years (Drott, 2006). Features such as the ability to link to related data, search full texts, or get quick desktop access to print out a PDF version, are variously found to be advantages of e-journals (Tenopir, *et al*., 2003). However, some databases and journals constituting digital libraries are very expensive and beyond the reach of many tertiary institutions, particularly in developing countries (Ochs, 2005; Lawson, 2015).

The researcher considers studies of access in developing countries in the following section.

2.4.2 Access in developing country institutions

A number of studies have been reported on access to e-resources in developing-country institutions (Rosenberg, 1997; Lund, 1998; Mark Ware Consulting, 2006; Harle, 2009; Amjad, Ahmed & Naeem, 2013; Samson, 2014; Egle, *et al.*, 2015).

As discussed in Chapter 1, the cost of scholarly publications remains prohibitively high for many tertiary institutions in developing countries (Mark Ware Consulting Ltd, 2006; Lawson, 2015). This leads to major differences in the type, size, coverage and quality of library collections accessible at these institutions, depending on their available budgets, ICT and internet infrastructure (Harle, 2009).

As indicated by Aronson (2005), new opportunities with digital information have led to a number of access programmes being established, including the Research4Life (AGORA, HINARI, OARE, ARDI) schemes (www.research4life.org) of the UN agriculture, health and environment agencies; INASP's PERI; and Cornell University's TEEAL (www.teeal.org). (See Chapter 3 for more details.) The schemes are targeted at improving developing countries' access to published literature, mainly scientific journals (American Phytopathology Society (APS), 2004; Mark Ware Consulting Limited, 2006). However, as argued by Malapela and De Jager (2015), while the emergence of electronic information has alleviated some of the problems and costs associated with printed materials, it has also presented its own obstacles, namely those of ICT infrastructure and internet connectivity. The savings associated with electronic formats have made books and journals more affordable (Colvin & Keene, 2004; Vent, 2005). However, this has resulted in an ever-growing need for substantial investment in computers, campus networks and internet access, meaning that in many cases, the costs have simply shifted elsewhere (Farrell & Isaacs, 2007; Ayoku & Okafor, 2015). Problems in this regard have also been noted in preceding sections (e.g. 2.2.2.2).

2.4.3 Access in African country institutions

As stated in Chapter 1, Africa is a major beneficiary of scholarly information access schemes such as the Research4Life, PERI and other programmes that have opened up access to expensive peer-reviewed international journals. However, studies by Rosenberg (1997), Fisher *et al*. (2007), Research4Life (2009), Ajuwon and Olorunsaye (2013), Ayoku and Okafor (2015) at several universities in Africa highlight the need for a new set of skills and approaches by librarians, faculty and students that may not be readily available at many universities in the region. In addition, as noted by Tenopir *et al*. (2003), Ajuwon and Olorunsaye (2013) and Ayoku and Okafor (2015), users in many disciplines at these institutions are embracing e-resources, but at different rates of acceptance and with reliance on different information-seeking patterns and user skills.

For example, Ajuwon and Olorunsaye (2013) conducted a study at the University of Ibadan, Nigeria, to assess the knowledge and use pattern of HINARI by clinicians and researchers in tertiary health institutions in south-western Nigeria in early 2013. The study covered 12 tertiary health institutions in six states of Nigeria through a self-administered questionnaire; 1 150 filled-in surveys were returned (64% response rate). The findings were that a majority (72.0%) were aware of HINARI. However, only 35.1% had had formal training on how to use the resource; 68% had ever used HINARI (Ajuwon & Olorunsaye, 2013).

Another study by Ayoku and Akafor of Nigeria, published in 2015, focused on the user skills and competences of librarians for a digital and electronic environment at the universities under the National Universities Commission. The study highlights a lack of skills in using specialised databases and some open access databases. The paper recommends management support for skills training and continuous development for the librarians to improve their skills. Librarians are also encouraged to use available online training resources to support self-development (Ayoku & Akafor, 2015; Ukachi, 2015; Akporhonor & Akpojotor, 2016).

Several of these studies point to the need to increase user awareness, user skills and improved competencies in e-resources in order to improve the use of the available resources for the benefit of the users, a situation that is common in many higher education institutions in Africa (Harle, 2010; Ajuwon & Olorunsaye, 2013; Ubogu, 2016).

2.4.4 Access at institutions in Zimbabwe

Zimbabwe has been beleaguered by economic, social, and political turmoil in recent years, which has had a debilitating effect on its already declining education system (Isaac, 2007; Shizha & Kariwo, 2011). Zimbabwe has undergone an economic collapse on an almost unprecedented scale. The economy has shrunk every year since 1999 and is now about 40% smaller than eight years ago (Moss, 2007). According to International Monetary Fund figures (IMF, 2007) about 35% of the population lived below the poverty line in 1996. This grew to an estimated 80% by 2003 (Moss, 2007). This rise in poverty and the associated erosion of state services has contributed to a shocking deterioration in already low human development indicators, dropping Zimbabwe in the United Nations rankings from 87th place in 1990 to 155th by 2004 (Moss, 2007). With an estimated unemployment rate of 90%, an economic turnaround will take a long time (Sigauke, 2011). Since the introduction of the multicurrency system, denominated by the US dollar, by the government in February 2009, all economic indicators have pointed to a slowdown in the rate of decline (Isaac, 2007) although there is still no sign of recovery for this hard-hit economy at the time of writing in 2016.

Mbambo (2001), Malapela (2014), Hogo (2010) and Mugwisi, Ocholla and Mostert (2014) argue that inadequate access to computers and limited bandwidth restrict the use of e-resources at universities in Zimbabwe. Malapela and De Jager (2015) and Malapela (2014) contend that the UZ's e-resources training sessions conducted by the library for faculty and students played a major role in addressing the problem of low use of library e-resources at the university. On the other hand, user logs to the Research4Life programmes indicate very low use in terms of actual article downloads for the country (Research4Life, 2009; WHO, 2014). This may be attributed to many problems with IT and internet infrastructure, electricity outages, limited access to computers and limited user skills, according to Mugwisi (2015).

The specific foci of studies regarding African tertiary institutions are covered in detail in the following sections. These include access to information, digital libraries and problems of accessing e-resources.

2.4.5 Selected studies on access to information in Africa

The challenges of access to information are highlighted in this section because they seem most important in the context of scholarly information at tertiary institutions, as also pointed out in preceding sections. Generally, access to information in Africa comes with many difficulties. Few institutions have information sharing strategies with adequate budget allocations to implement the strategies (Chisenga, 2004; Ubogu, 2016).

As discussed in Chapter 1, access to digital libraries in African tertiary institutions is made difficult by inadequate IT and internet infrastructure, bandwidth shortages, lack of awareness of available resources and users lacking adequate skills to take advantage of the resources (Ajuwon & Olorunsaye, 2013; Ukachi, 2015). Many of the challenges in access reported in studies relate to access to a specific type of resource. Rosenberg (2008), Musoke and Kinengyere (2008), Mugwisi, Ocholla and Mostert (2014) and Dulle (2015) support these points.

Studies have been done to establish the effectiveness, acceptance, level of adoption and use and perception by users of e-resources at tertiary institutions, particularly in developed countries, focusing on the specific types of e-resources, the nature of problems experienced and specific issues of importance, such as user culture, etc (Bancroft *et al*., 1998; Tomney & Burton, 1998; Bar-Ilan, Peritz & Wolman 2003; Frame, 2004; Gyamfi, 2005; McDonald, 2006; Cullen & Chawner, 2008; Tilvawala, Myers & Andrade, 2009; Harle, 2010; Thanuskodi, 2012; Prasannan, Gabbur & Haughton, 2014; Samson, 2014; Tripathi & Kumar, 2014). The following sections delve into the findings of studies at African institutions.

Studies indicate that most African tertiary education institutions are making efforts to provide access to scholarly materials, using e-resources as an important source of up-to-date scholarly publications (INASP, 2003a; Vent, 2005; Rosenberg, 2006; Mbambo-Thata, 2007; Wu & Ochs, 2007; Manda, 2008; Musoke & Kinengyere, 2008).

Research papers by Rosenberg (2006), Kinengyere (2007), Yusuf and Iwu (2010), Harle (2010), Ajuwon and Olorunsaye (2013) and Dulle (2015) all assert that university libraries no longer focus their efforts on serving as repositories for printed materials, but instead are delivering most information that they provide to their community in both print and online formats. Although this is true of tertiary institutions in the developed countries, in developing countries, particularly in Africa, the situation is different (Musoke & Kinengyere, 2008). The high cost of building, accessing and maintaining e-resources on the one hand, and on the other the limited level of user skills and inadequate available IT and internet infrastructure, have been reported to limit the adoption and use of e-resources at African tertiary institutions. Thanuskodi (2012), Ayoku and Okafar (2015) and Dulle (2015) support this view. However, the issue of cost should not apply to sources available free – such as the e-resources noted in Table 1.1.

Research findings on the different types of information resources, such as digital libraries, databases, e-journals and institutional repositories, give a clearer picture on the efforts of these universities and colleges to give the academic staff and students access to these resources. Table 2.4 below outlines a number of important studies carried out in the last decade in several African countries on the above-mentioned aspects at research and academic institutions. Their methodologies and findings have influenced this study to a great extent and are discussed and referred to in the following sections.

Table 2.4 Summary of important studies on access to and use of e-resources undertaken in African countries in the past decade

Study title and purpose	Method	Findings
Dulle (2015). Online information resources availability and accessibility: a developing country's scenario This paper examines the extent to which developing countries have taken advantage of the new developments in ICTs to improve scholars' access to and use of scientific literature.	Through a meta-analysis approach, core literature reviews published from 2005 to 2014 are used to assess the availability and use of online scholarly content, as well as factors affecting effective exploitation of online scholarly information resources.	Although various initiatives capitalising on ICT developments have eased the problem of availability of scholarly content in most developing countries, there are still obstacles to effective use of online scholarly literature. Problems and barriers found were unreliable power supply, inadequate awareness of the availability of e-resource, low levels of information literacy, lack of perpetual access rights to acquired resources (i.e. paid-for content) and users' interest in the use of search engines. Information literacy delivery strategies and adoption of discovery tools are recommended for improving accessibility to and the usage of online scholarly literature in developing countries.
Ayoku & Akafor (2015). ICT skills acquisition and competencies of librarians: implications for digital and electronic environment in Nigerian university libraries The paper audited IT skills sets of librarians in Nigerian university libraries with the aim of examining their relevance and adequacy for the digital environment.	The method used was surveys, with a stratified sampling technique, in a selection of universities under the National Universities Commission. The survey focused on the user skills and competences of librarians for a digital and electronic environment at the universities.	The findings highlight the lack of skills in specialised databases, some open access databases, subject gateways, database management skills and lack of familiarity with Web 2.0 applications. The paper recommends management support for skills training and continual development for librarians to improve relevant skills. Librarians are also encouraged to use available online training resources for self-development.
Mugwisi, Mostert & Ocholla (2015). Access to and utilisation of information and communication technologies by agricultural researchers and extension workers in Zimbabwe The study investigated the levels of ICT access and use by researchers and extension workers in the Ministry of Agriculture in Zimbabwe, and how this affected the generation and dissemination of agricultural information among researchers and extension workers.	Survey questionnaires were distributed to researchers at the various institutes in the five agro-ecological zones, and to extension workers in ten provinces.	The study findings indicate that the role of ICTs in work and as an information channel was considered inadequate, despite the majority of extension workers and researchers having access to ICTs.
Mugwisi (2014). Role of librarians in teaching information literacy in Zimbabwean and South African universities: a comparative study The purpose of the study was to examine the	This was done by examining whether such IL programmes were prioritised, what their content was and how frequently they were reviewed. An electronic questionnaire was distributed to 12 university libraries	The findings revealed that IL was being taught in university libraries and to non-library staff. Taking the course was compulsory and contributed to the term mark in some institutions. The study also found that 44% of all respondents indicated that the libraries

teaching of information literacy in universities in Zimbabwe and South Africa, and the role played by librarians in creating information-literate graduates.	in Zimbabwe and 21 in South Africa. A total of 25 questionnaires were returned.	were collaborating with departments and faculty in implementing IL programmes in universities. The study recommends that IL should be an integral part of university programmes in order to promote the use of databases and to guide students on ethical issues of information use.
Ajuwon & Olorunsaye (2013). Knowledge, access and usage pattern of HINARI by researchers and clinicians in tertiary health institutions in south-west Nigeria The purpose of the study was to assess knowledge and use patterns of HINARI by clinicians and researchers in tertiary health institutions in Nigeria's south-western region.	The study covered 12 tertiary health institutions in six states of Nigeria in the south-western region through a self-administered questionnaire; 1 150 filled-in surveys were returned (64% response rate).	The findings indicated that a majority (72.0%) were aware of HINARI. However, only 35.1% had had formal training on how to use the resources and 68% had used HINARI.
Ajiboye & Bankole (2013). The use of library electronic information resources by academic staff at Federal University of Agriculture, Abeokuta The study investigated the use of library e-resources by academic staff of the Federal University of Agriculture, Abeokuta, Ogun State, Nigeria in the 2010 academic session. It examined awareness, use patterns, purpose of use, satisfaction level, opinions on contribution of e-resources to academic activities and constraints faced in using the resources among the academic staff.	One hundred and sixty six copies of the questionnaire were administered to academics, of which 144 copies were retrieved and used for this study.	The study found that 93.75% of the respondents were aware of library e-resources, while 91.1% of those who were informed had used the resources. The majority of respondents acquired e-resources use skills on their own (personal efforts) by trial and error and through guidance by colleagues. The most used e-resources in decreasing order were CAB Abstract, TEEAL, AGORA, E-Granary and HINARI. The academic staff used electronic resources for research, to update their subject knowledge, to guide research students and to collect teaching materials. Responses indicated that 29.3% were fully satisfied with the e-resources, while 43% were satisfied. The main constraints in using e-resources were lack of time to use them because of other work demands, frequent power outages, slow internet access and slow downloading. The study recommends that a concerted effort be made by the university library to promote the use of its e-resources, and that information technology skills training for the staff should be an ongoing exercise.
Harle (2009). Digital resources for research: a review of access and use in African universities. The paper draws on a literature review undertaken by the Association of Commonwealth Universities, as part of a study commissioned by Arcadia (www.arcadiafund.org.uk) on the obstacles to accessing and using digital scholarly information in African universities.	The study focused on four universities in East and Southern Africa – the universities of Nairobi, Dar es Salaam, Rwanda and Malawi (Chancellor College). Data were based on a literature review and visits to the institutions.	Key findings were that on average 79% of the top-ranked international journals were available for free at point of use at the four universities, but researchers reported that they struggled to get hold of the journals they needed. Access schemes have helped to increase the availability of academic journals across Africa dramatically, and many countries have established library consortia to co-ordinate subscriptions nationally. Technology constraints pose significant problems, but access to computers and broadband connectivity is steadily improving.

		Researchers' awareness of resources and search skills are often underdeveloped; many of them are unable to find and download what they need.
Yusuf & Iwu (2010). Use of academic library: A case study of Covenant University, Nigeria. This study examines the extent of use of library resources at Covenant University, Nigeria.	Two questionnaires were used to gather data. Four hundred registered library users were selected using the stratified random sampling technique.	Eighty-eight percent of the students sampled visited the library to read for examinations, while most faculty members visited the library to read journals, whether electronic or print. Students used OPAC more than faculty members did. It is recommended that faculty members give reading assignments that will require students to consult journals and other resources in the library, and not just use it for examination purposes.
Hadebe & Hoskins (2010). Information seeking behaviour of master's students using library electronic databases in the Faculty of Humanities, Development and Social Sciences of the University of KwaZulu-Natal The purpose of this study was to investigate the use of electronic databases by master's students in the Faculty of Humanities, Development and Social Sciences at the University of KwaZulu-Natal, Pietermaritzburg campus.	The methodological approach was quantitative. Data were collected using a questionnaire. The study, which was based on a master's dissertation, aimed to establish which electronic databases master's students used and how frequently they were used. The conceptual framework for the study was rooted in Kuhlthau's Information Search Process.	A majority of master's students in the Faculty of Humanities, Development and Social Science at the University of KwaZulu-Natal, Pietermaritzburg, used electronic databases and a number of problems were experienced when using these databases. It was recommended that the library should ensure that training or user education continued and met all the various users' needs, improve students' access to the databases by limiting the need for passwords, improve the internet bandwidth to enhance the speed of connection and use the internet and web-based services such as newsgroups, bulletin boards and Web 2.0 facilities to communicate with users.
Soyizwapi & Hoskins (2009). Use of electronic databases by postgraduate students in a university based Faculty of Science and Agriculture The purpose of this study was to investigate the use of electronic databases by postgraduate students in the Faculty of Science and Agriculture at the University of KwaZulu-Natal, Pietermaritzburg.	The study adopted a quantitative approach and a survey was conducted.	The results of the study found that while postgraduate students used the electronic databases, a few of the databases were not used. Postgraduate students experienced a number of problems when using the databases. Students became aware of the availability of electronic databases from a variety of sources, such as friends, library orientation programmes and academic staff. Search engines were identified as a resource that was very popular with almost all the students. The study revealed that there was a need for improving access to the databases for all campus and off-campus users.

Kinengyere (2007). The effect of information literacy on the utilization of electronic information resources in selected academic institutions The paper examined the effect information literacy had on the use of e-resources in academic and research institutions in Uganda. It concentrated on the innovations that Makerere University Library had undertaken to ensure that library users were trained on accessing a variety of available information resources, evaluating the information and applying it to address their needs.	Data were collected using interviews with library staff and users at the selected institutions: two library staff members in charge of e-resources and ten students and researchers were interviewed from each institution. User statistics for the years 2004-2005, and the information literacy training sessions conducted, were the main sources of information. The study focused on academic and research institutions – Makerere University, Uganda, Martyrs' University, Nkozi and National Agricultural Advisory Services. The researcher was personally involved in the IL programme in Makerere University.	The availability of information does not necessarily mean actual use. Some of the available resources had not been used at all. This means that users were not aware of the availability of such resources, they did not know how to access them, or they did not know what the resources offered. All this calls for continued IL programmes. IL is vital in influencing use of e-resources. Information professionals are needed to pass on IL skills to library users, while library users should endeavour to find out what information is available online for their consumption. Their attitudes and perceptions also influence the level of use.
Rosenberg (2006). Towards the digital library in Africa The study was commissioned in 2004 by INASP to find out the state of digitisation in university libraries in Sub-Saharan Anglophone Africa.	Questionnaires were sent to 107 libraries in 20 countries. The response rate was 72%. Site visits and interviews took place in five countries, followed by a focus group discussion with librarians from four countries.	In 2004, university libraries in Africa had progressed towards establishing digital library services at very different speeds and levels. Libraries therefore had very different needs and ambitions**.** E-resources were available at most universities, but facilities for access were poor. The acquisition and implementation of a library management system appeared to be essential to the construction of a digital library. All e-developments depended heavily on external funding. Lack of funding and lack of or retention of trained staff were key problems.

2.4.6 Digital libraries

According to the research reports on African universities, digital libraries provide opportunities to access and retrieve scholarly information that is often difficult to obtain in developing country institutions (Kling & Covi, 1997; Vent, 2005; Drott, 2006; Wu & Ochs, 2007; Park *et al*., 2007; Amjad, Ahmed & Naeem, 2013; Ugwu. & Onyegiri, 2013; Mugwisi, 2014; Dulle, 2015). The predominant organisation of digital libraries today is by their intellectual content or disciplinary focus. As stated in previous sections, at African tertiary institutions reports indicate that the use of digital libraries is increasing, but slowly, mainly because of inadequate budget allocations, limited information technologies and internet infrastructure, inadequate bandwidth and user skills limitations (De Groote & Dorsch, 2003; Anbu, 2006; Soyizwapi & Hoskins, 2009; Hadebe & Hoskins, 2010; Hoskins, 2012; Dulle, 2015; Mugwisi, 2015). Rosenberg (2008) and Ayoku and Okafor (2015) concur with these arguments and highlight them as frequent major barriers to access to digital libraries. They note particularly power supply problems at universities in most of Sub-Saharan Africa. Insufficient knowledge of what is available and how to access it compounds the problems of access to digital libraries at African universities (Fisher *et al*., 2008; Harle, 2010; Ajuwon & Olorunsaye, 2013; Ugwu. & Onyegiri, 2013; Dulle, 2015). Table 2.3 below outlines several routes to access scholarly publications at tertiary institutions. It focuses on type and mode of access.

Table 2.3 Accessing digital scholarly information

Tertiary education institutions' library collections	Accessing digital scholarly information resources
Type of access	Subscription or fee-based (Emerald, Science Direct, EBSCO, etc)
	Free access (e.g. AGORA, HINARI, OARE, institutional repositories)
	Open access (e.g. DOAJ; Public Library of Science – PloS, etc)
	Low-cost special contracts for developing countries (e.g. TEEAL, PERI, EIFL, etc)
Mode of access (offline or online)	CDs or DVDs, computers, mobile phones, e-reader (e.g. Kindle, Sony e-reader, etc)

The problem of inadequate bandwidth at African universities has been noted. However, even where campuses are linked to high-speed bandwidth, it was found that the local area networks (LAN) need to improve in order to provide adequate access points on campus for students and academic staff (Lund, 1998; Rosenberg, 2006; Harle, 2010; Dulle, 2015). The ability of individual institutions to derive full benefit from the cable and networking projects depends on ICT and networking infrastructure at campus level (Adeya & Oyelaran-Oyeyinka, 2002b; Harle, 2009; Pons *et al*., 2015). According to the African Tertiary Institutions Connectivity Study survey of 2005, computers were shared by an average of 55 people at several of the Sub-Saharan universities surveyed (Gakio, 2006). This was a significant improvement on the figures published by the Association of Commonwealth Universities (ACU) and Rosenberg studies of 1997 and 1998, which indicated that most universities in the region had fewer than one computer for every 500 students (Harle, 2010). In Southern African universities (outside South Africa) Southern African Regional Universities Association (SARUA) (2008) gave a figure of 40 students per computer and two teaching staff per computer, indicating that while academic staff were reasonably better served, students were not. Hence many of the students at Makerere University in Uganda relied on internet cafes outside the university to get access to computers (Musoke &

Kinengyere, 2008). As argued by Pons *et al*. (2015), campus networks are critical, since they make an institution's external network available to multiple users and enable data to be shared more effectively internally.

It is important to note that these ICT infrastructure and facility problems not only affect access to digital libraries, but cut across all online resources, including databases, e-journals and e-books.

Harle (2009) argues that students are likely to have had limited opportunities to explore the internet and use computers prior to university, which limits their ability to make the best use of them for academic purposes and they are consequently likely to lack awareness of the scholarly potential of online resources. This point is supported by other studies such as by Fisher *et al*. (2008), Hadebe and Hoskins (2010) and Ayoku and Okafor (2015).

A study of internet use in Kenyan and Nigerian universities in 2002 demonstrated that internet use was relatively low and was mainly for e-mail or accessing specifically recommended websites, rather than for academic research of significant depth (Adeya & Oyelaran-Oyeyinka, 2002a). However, more recent studies by Scott (2006), Soyizwapi and Hoskins (2009), Hadebe and Hoskins (2010), Ajuwon and Olorunsaye (2013), and Mugwisi (2015) indicate that this is changing, with a significant increase in the use of e-resources found in studies of universities in Ghana, Kenya, Malawi, Nigeria, Tanzania, South Africa, Zambia and Zimbabwe.

Lawrence Chikwanha, university librarian at Great Zimbabwe University (GZU), reports that "the use of e-resources is generally low because the university started providing access to resources this year. The university has very weak IT infrastructure and also in the previous years, it could not afford to pay for access to such library e-resources at the PERI resources" (Chikwanha, 2014).

Regarding the internet infrastructure for students and faculty, Chikwanha (2014) indicated that the LAN at Great Zimbabwe University (GZU) was completed only in 2009 and was "in its infancy in terms of the e-resources services offered". LAN access points were limited across the two university campuses and while there were a number of computer laboratories for academic staff and students "the computers in these labs are old and unreliable and in most instances they are not connected to the internet". A number of users were still using dial-up to connect to the internet and these computers did not benefit from the electronic library resources that the university had access to and were accessed via an IP address authentication system that ran through the university's LAN. The LAN had about 100 computers, of which ten were in the library and were accessed by the student population of 2 500. The whole network was connected via a 512 Kbps connection to the internet via a radio link (Chikwanha, 2014).

The case of Great Zimbabwe University is similar in some aspects to the situation at other universities in Zimbabwe and the region. Many academic libraries in Africa cannot afford the subscription needed to maintain good collections across all subject areas, even when rates are substantially reduced; many depend on external funding to pay for subscriptions, either on an individual basis or as part of national licensing arrangements (Chikwanha, 2014; Malapela, 2014; Malapela & De Jager, 2015; Mugwisi, 2015). But as indicated in Chapter 1, there are a number of access schemes that together enable African libraries to access a huge amount of academic material at low or no cost, including substantial collections available through the well-known Research4Life programmes (AGORA, HINARI, OARE, ARDI), PERI and EIFL programmes (Mark Ware Consulting Ltd, 2006; Rosenberg, 2006; Harle, 2009; Mugwisi, 2014; Dulle, 2015; Gaible, 2015).

As rightly argued by Dulle (2015), the provision of free resources does not mean that access itself is free, since the costs of purchasing and maintaining ICT equipment and managing access to resources must also be accounted for. In fact, a Network for the Availability for Scientific Publication (INASP) study conducted in 2008 argues that with so many free or discounted access initiatives available to African universities, the problem is far from a lack of access to electronic resources, but instead an issue of libraries' capacity to make full use of these and to access what they are entitled to (Rosenberg, 2008). This assertion is corroborated in other studies by Anbu (2006), Fisher *et al*. (2008), Ajuwon and Olorunsaye (2013) and Mugwisi (2015).

The studies by Scott (2006), Ajuwon and Olorunsaye (2013), Dulle (2015), Mugwisi (2015), and Abubakar and Adetimirin (2015) cite other difficulties, such as limited skills of librarians, academics and students. For instance, at many African libraries staff lack high-level web-authoring skills to develop good library websites and portals that allow them to manage access systematically and in a way that allows users to navigate resources more easily. The need to manage multiple passwords and to access multiple platforms and differing interfaces, which are not always easy to search, can also make use of existing materials difficult. However, it must be noted, as argued by Kiondo (2008), that these

African libraries are typically at different stages of digital development and this has significant implications for their ability to make use of electronic and online resources.

An Association of Commonwealth University survey (2009) and Richardson and Kennedy (2014) state that supporting librarians' professional development, particularly their ICT and web skills and expertise, will be vital in electronic access and use of resources if these are to be improved. Manda (2008), Ajuwon and Olorunsaye (2013), Oyewo and Bello (2014), Mugwisi (2015), and Ukachi (2015) agree with this statement. "Librarians increasingly need to become 'digital librarians' if they are to harness and provide the full potential of electronic information for their users" (Harle, 2010: 44).

A study at the University of Zimbabwe's digital library suggests that a critical factor in its success was the creation of a dedicated ICT unit in the library (Mbambo, 2006).

2.5 PROBLEMS OF ACCESSING INFORMATION RESOURCES IN DEVELOPING COUNTRIES

As shown in the preceding discussion, digital libraries offer a wealth of information for research, teaching and learning at universities worldwide. However, access is only possible, effective and efficient where the IT and internet infrastructure support systems and user skills are adequate (Rosenberg, 2008; Dulle, 2015; Mugwisi, 2015; Akporhonor & Akpojotor, 2016). As noted, thousands of electronic scholarly publications are available free or at low cost online for developing countries' tertiary institutions (INASP, 2008; Harle, 2009; Dulle, 2015). However, use by users in developing countries, although gradually growing, is still very low, particularly in tertiary and research institutions in Sub-Saharan Africa (Megersa & Mammo, 2008; Musoke & Kinengyere, 2008; Ajuwon & Olorunsaye, 2013; Dhanavandan, 2014; Miller, 2014; Mugwisi, 2015; Akporhonor & Akpojotor, 2016).

Findings from the following studies all pointed to the problems of low use of e-resources at academic and research institutions by academic staff, librarians, students and researchers:

- Akporhonor and Akpojotor, (2016): Challenges confronting postgraduate library and information science student in the use of electronic resources in Southern Nigeria.
- Dulle (2015): Online information resources availability and accessibility: a developing countries scenario.

- Abubakar and Adetimirin (2015): Influence of computer literacy on postgraduates' use of e-resources in Nigerian university libraries.
- Akussah *et al*. (2015): Impact of electronic resources and usage in academic libraries in Ghana: Evidence from Koforidua Polytechnic & All Nations University College, Ghana.
- Conway (2015): One-shot library instruction sessions may not increase student use of academic journals or diversity of sources.
- Gaible (2015): Research4Life user experience review report.
- Ayoku and Akafor (2015): ICT skills acquisition and competencies of librarians' implications for digital and electronic environment in Nigerian universities libraries.
- Ajuwon and Olorunsaye (2013): Knowledge, access and usage pattern of HINARI by researchers and clinicians in tertiary health institutions in South-west Nigeria.
- Ajiboye and Bankole (2013): The use of library electronic information resources by academic staff at Federal University of Agriculture, Abeokuta.
- Hadebe and Hoskins (2010): Information seeking behaviour of master's students using library electronic databases in the Faculty of Humanities, Development and Social Sciences of the University of KwaZulu-Natal.
- Soyizwapi and Hoskins (2009): Use of electronic databases by postgraduate students in a university based Faculty of Science and Agriculture.
- Kinengyere (2007): The effect of information literacy on the utilization of electronic information resources in selected academic institutions.
- Rosenberg (2006): Towards the digital library in Africa.

While the use of e-resources at universities and colleges varies significantly between and even within countries in Sub-Saharan Africa, common barriers are cited in many institutions (Chisenga, 2004; Akussah *et al.*, 2015; Gaible, 2015; Akporhonor & Akpojotor, 2016). The most commonly cited barrier to use has been the high subscription costs of journals (Mark Ware Consulting Ltd 2006; Kiondo, 2008; Dulle, 2015; Lawson, 2015). This may be only one aspect of the problem (Kiondo, 2008; Dulle, 2015). Inadequate IT and internet bandwidth, limited relevant content, lack of awareness by potential users and inadequate skills are the other barriers cited as facing information users at tertiary institutions in developing countries (Chisenga, 2004; Lwoga *et al*., 2007; Manda, 2008; Musoke & Kinengyere, 2008; Rosenberg, 2008; Research4Life, 2009; Ajuwon & Olorunsaye, 2013; Mugwisi, 2014; Dulle, 2015; Gaible, 2015). Based on findings of these studies and considering the discussion of access problems in section 2.4, Table 2.4 below shows these broad categories of problems of e-resource access and use at African tertiary education institutions, which contribute to reported low information resource uptake, low quality of information used and according to King (2005) and Ezema (2009), a low number of scholarly publications coming from developing countries to the international arena.

Similar access issues were reported in a recent study by Gaible (2015), which offers results of an assessment of the Research4Life initiative. The study made use of site visits to 39 institutions in nine countries (Bangladesh, Uganda, Vietnam, Ecuador, Cameroon, Ghana, Nigeria, Moldova and El Salvador) and web-based questionnaires. Participants from the 39 institutions completed 1 321 questionnaires. The respondents were mainly researchers, educators and practitioners. Questionnaires were offered in English, French and Spanish, with responses aggregated for analysis. Of the researchers, educators and practitioners surveyed, 243 had used Research4Life at least once in the preceding 30 days. Surveys were carried out in March and April 2015.

Several points from Gaible (2015) are important for this study:

- Use of Research4Life by respondents was moderate in registered institutions: 48% of respondents in the interviews conducted at field sites stated that they had used Research4Life at least once during the preceding 30 days; 20% stated that they had used it more than ten times in the same period.
- Primary barriers to more effective use of the Research4Life programmes, as reported by interview respondents, centred on the use of programme websites and tools, with an additional barrier posed by internet bandwidth.
- Of the senior researcher and general researcher interview respondents, 69% reported that finding resources relevant to their objectives posed a barrier to their use of research information, while 36% or less cited access-related factors as barriers.
- Senior and general researcher interview respondents cited several access problems as barriers to the use of Research4Life programmes, specifically to full-text articles (45%), finding relevant resources (27%), login and password issues (24%), and the complexity of the Research4Life site (13%). Internet bandwidth affected both search and full-text access.
- The report indicated that improving users’ skills and knowledge in relation to Research4Life was likely to be an effective means of addressing challenges related to login, password and full-text access.

- "Auto-login", an innovation introduced by Research4Life programmes (but not widely implemented) increased users' success rates in accessing full-text articles.

Table 2.4 summarises information access problems from findings of the above-mentioned studies on what contributes to low use of e-resources at African academic and research institutions.

Table 2.4: Information access problems in developing countries

Category	Access problems	Content problems	Lack of user skills
Types of access barriers	• Inadequate IT and internet infrastructure • High cost of serial subscriptions • Inadequate and expensive bandwidth • Power outages	Information overload. Vast quantities of information are available via internet, which are difficult to search through and find relevant, required information Relevancy of information	Lack of awareness and effective search skills Lack of content evaluation skills on retrieved information Lack of research culture
Outcome	Low information uptake and usage	Low quality information retrieved and used	Few publications from developing countries

2.5.1 Inadequate IT and internet infrastructure

As alluded to in earlier sections, the problem of access to information is the biggest barrier to information uptake and use in African universities and colleges, especially in the Sub-Saharan Africa region outside South Africa. This is largely attributed to the problems of inadequate IT and internet infrastructure, as well as limited and expensive internet bandwidth at the tertiary intuitions. A study commissioned by the FAO in 2009 under the Research4Life programme in five developing countries (Ghana, Honduras, Tanzania, Uganda and Vietnam) on factors underlying differences in use levels for the Research4Life programmes (HINARI, AGORA, OARE and ARDI) at 10 selected universities has similar findings. The study found that the differences between heavy and light user universities (according to user logs) came down principally to four important barriers: inadequate bandwidth or speed of the internet, cost of internet access, lack of access to a PC or terminal, and competition for access to the internet. These four intertwined technological problems were reported at all the institutions surveyed and contributed to the differences in use levels at the 10 universities (Research4Life, 2009).

Availability of computers with fast internet for academic staff and students at many African universities and colleges is reported to remain very difficult because of the increased numbers of the population, and investment that has not kept up with expansion at the institutions. Several studies have indicated that non-use or low use of e-resources in African countries was attributable to problems of accessibility, ease of use and cost (Ehikhamenor, 2003; Scott, 2005; Rosenberg, 2006; Watts & Ibegbulam, 2006; Fisher *et al*., 2008; Rosenberg, 2008; Harle, 2009; Hadebe & Hoskins, 2010; Dulle, 2015; Mugwisi, 2015).

The laying of new undersea telecommunication cables that bring the internet to African shores in 2009 has increased cheaper bandwidth on the continent (World Wide Worx, 2009; Association of Commonwealth Universities, 2011; UbuntuNet Alliance, 2015). This development improved access to the internet, for instance through the granting of licences that permit internet service providers to build their own networks, issuing of Wi-Max licences, growth of cell phone internet, and migration to digital TV, among other developments (World Wide Worx, 2009; ITU, 2010; Akue-Kpakpo, 2013).

Continued efforts to use mobile phones to improve access to information in developing countries are taking advantage of the increased mobile phone penetration in these countries (ITU, 2010; Akue-Kpakpo, 2013; Salehan & Negahban, 2013; Asongu, 2015; Debsu, *et al.*, 2016; Svensson & Larsson, 2016). The 2010 International Telecommunication Union (ITU) report, "Measuring the information society 2010", indicated that by the end of 2009 there were an estimated 4,6 billion mobile cellular subscriptions, corresponding to 67 per 100 inhabitants globally, and mobile cellular penetration in developing countries had more than doubled since 2005, when it stood at only 23%. Compared to only 4% internet broadband penetration in developing countries, this is a significant improvement. Several initiatives to improve access to information have taken advantage of mobile phone technology in Africa and are delivering, for instance, agricultural commodity market information, e.g. the Kenya Agricultural Commodity Exchange in Kenya and Marketing Information System, a similar service in Mali, etc (Akue-Kpakpo, 2013: Asongu, 2015; Debsu, *et al.*, 2016; Svensson & Larsson, 2016).

With most scholarly information currently being published outside Africa online (in digital format) and also hosted outside the continent, the extent to which African libraries are able to develop digital resources largely depends on their access to international broadband networks and the speed and reliability of these (Harle, 2010; Ubuntunet, 2015; ITU, 2016). Improved broadband provision on the continent and infrastructure investment provide hope and great potential education and research networks on the continent (Gelvanovska, 2014; Bassey, 2016).

2.5.1.1 African broadband internet infrastructure

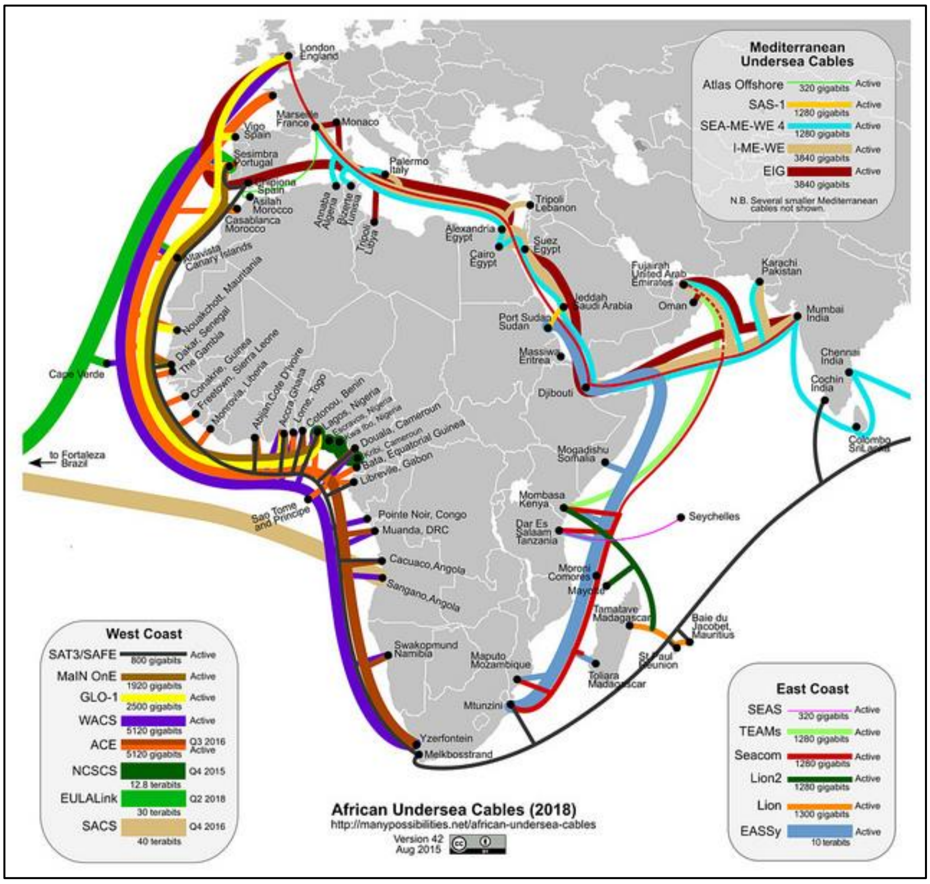
In 2009 and 2010 the SEACOM and EASSy undersea cables were launched, respectively, aimed at increasing internet connectivity speeds and lowering bandwidth costs on the African continent (Juma & Moyer, 2008; *The Kenya Engineer*, 2009; Gelvanovska, Rogy & Rossotto, 2014; Bassey *et al.*, 2016). The submarine fibre-optic cable system linking South and East Africa to global networks via India and Europe added a capacity of 6,5 terabytes per second (Tb/s) (Song, 2015). Steve Song's blog provides more specific detail on the connection of African countries (SARUA, 2008; Jagun, 2009; Akue-Kpakpo, 2013).

The expected increase in the number of submarine cables by 2018 means that almost all African coastal cities will be served with affordable bandwidth (Bassey *et al*., 2016; ITU, 2016). Figure 2.1 below shows a number of new large-scale submarine cable projects under way, which will progressively improve the links of many parts of Africa with European and Asian networks and which will have great potential for substantially improving data communication for research and education when completed (SARUA, 2008; Association of Commonwealth Universities, 2011; Akue-Kpakpo, 2013; Ubuntunet, 2015; ITU, 2016).

2.5.1.2 Broadband internet connectivity within Africa

In some cases ICT and internet infrastructure implementation is delayed in part by lack of an overall framework and national technology plan (Association of Commonwealth Universities, 2011). The Research and Education Networks (RENs) are groups of tertiary education and research organisations collaborating with national or regional broadband networks (UbuntuNet Alliance, 2015). UbuntuNet Alliance (www.ubuntunet.net) works to secure affordable high speed international connectivity and efficient ICT access and usage for African NRENs (Association of Commonwealth Universities, 2011; Bassey *et al.*, 2016) and is based on the collaboration of 20 Eastern and Southern African countries (UbuntuNet Alliance, 2015).

Figure 2.1 African undersea cables providing needed internet bandwidth[5]



2.5.1.3 Broadband internet infrastructure

As noted by Watts and Ibegbulam (2006), Gbaje (2007), Rosenberg (2008), Association of Commonwealth Universities (2011), Ajiboye and Bankole (2013), Oyedapo and Ojo (2013), Mugwisi (2014), Dulle (2015) and Edmond Gaible (2015), investigations into the situation regarding access to e-resources in developing countries reveal the problem of inadequate IT and internet infrastructure at tertiary education and research institutions in Africa.

For example, Watts and Ibegbulam's study (2006) focusing on the circumstances at the Medical Library, College of Medicine, University of Nigeria identified a number of issues, mainly lack of adequate ICT infrastructure and affordable bandwidth enabling online access. This situation is prevalent at many similar tertiary institutions in Sub-Saharan Africa outside South Africa, as recent findings by Ajuwon and Olorunsaye (2013) and Mugwisi (2015) have confirmed. Overall it seems there is a repetition of findings on challenges faced in Africa with too little progress, even now that a core problem of cost has been addressed by initiatives, as indicated in Table 1.1 and in Table 2.4.

[5] Steve Song's blog https://manypossibilities.net/african-undersea-cables/

2.5.2 High cost of serial subscriptions

As explained in section 1.2.3, higher journal subscription fees remain one of the obstacles to accessing scholarly literature for developing-country users. According to the ARL (2005), the annual price rise for peer-reviewed journals over the period 1984-2004 was 7.6%, outpacing an average global inflation rate of 3.3%, and by 2005 subscription fees averaged \$1 000-\$3 000 per annum for STM journals. These high prices have contributed to developing-country institutions cutting subscriptions to scholarly publications year after year (Aronson, 2004). According to Teskey and Urquhart (2001:245), "Even in developed countries the cost of subscriptions is a major factor for purchasing decisions for electronic resources". More recent studies by Day (2010), Geraldine (2013), Tillack (2014), Lawson (2015), Dulle (2015) and Malapela and De Jager (2015) assert the problem of the continued high cost of journal subscriptions for developing countries' tertiary institutions.

However, for fee-based access there are flexible online information resources licensing terms that publishers have adopted over the years to meet user needs, particularly in developing countries (Scott, 2006; Kaser, 2009; Harle, 2010). For instance, several e-journal initiatives now offer developing country users free or low-cost access to thousands of e-journals via arrangements with the journal publishers (Association of Commonwealth Universities, 2011). However, as noted in section 2.2.2.4, depending on the service provider, there may be embargoes on access to journal articles. A study by the Academic Librarians in Public Service in the USA asserts that licensing terms have become more generous, as publishers have become more comfortable with the use of digital content, including allowing its use in virtual learning environments and repurposing it to create learning objects (Kaser, 2009). The Research4Life programmes (AGORA, HINARI, OARE, ARDI) and TEEAL initiatives are good examples of programmes aimed at giving free access to universities and colleges in developing countries (Oduwole & Sowole, 2006; Harle, 2009; Association of Commonwealth Universities, 2011). According to Gaible (2015) and FAO (2015), the majority of the eligible universities and research institutions in Sub-Saharan Africa had registered to use the Research4Life programmes by 2015.

2.5.3 Problems in dealing with information content and user skills

A common point in the literature is the paradoxical situation that although there is an abundance of information available, it is often difficult to obtain useful, relevant information when it is needed (Edmunds & Morris, 2000; Harle, 2009; Association of Commonwealth Universities, 2011; Bawden, 2014; Bhat & Ganaie, 2016).

Edmunds and Morris (2000), Frame (2004), Morahan-Martin (2004), Rosenberg (2008) and Bawden (2014) all report that abundant information can be overwhelming if the information available through e-resources is not properly managed. Increased connectivity can quickly lead to information overload, and selecting relevant and useful information in such an environment is difficult for users (Lynch & Preston 1990; Edmunds & Morris, 2000; Dillon, 2001; Frame, 2004; Palladino, 2007; Williams, Nicholas & Rowlands, 2010; Association of College & Research Libraries, 2014; Tonsaker, Bartlett & Trpkov, 2014; Bhat & Ganaie, 2016). Sifting through the tonnes of information on the web can be inefficient without effective search skills and the ability to evaluate retrieved information (Witten, 2000; Palladino, 2007; Bhat & Ganaie, 2016). Users (particularly students) at many universities in Africa lack adequate search skills to manage the information overload found through electronic resources and the internet effectively (Rosenberg, 2008; Kandpal, Rawat & Vithal, 2013; Association of College & Research Libraries, 2014; Mugwisi, 2015; Bhat & Ganaie, 2016). Without the necessary search skills it is difficult for untrained users to find exactly what they are searching for (Kandpal, Rawat & Vithal, 2013; Tonsaker, Bartlett & Trpkov, 2014; Mugwisi, 2015; Bhat & Ganaie, 2016). At the same time these users may also find it difficult to identify what constitutes a good journal title or article and to evaluate and use it appropriately (Lynch & Preston, 1990; Morahan-Martin, 2004; Williams, Nicholas & Rowlands, 2010; Kandpal, Rawat & Vithal, 2013; Bawden 2014; Pons *et al*., 2015).

Another challenge is that information found in the e-resources may have been generated in research undertaken in regions of the world that bear little resemblance to Africa, making some of the information obtained less relevant (Harle, 2010). As argued by Musoke and Kinengyere (2008) and supported by Ajuwon and Olorunsaye (2013) and Bhat and Ganaie (2016), information users need to be equipped with the right skills to make the right decisions on using the information accessed and retrieved from e-resources and the web. These are competencies students need to develop (Mbambo-Thata, 2007; Mugwisi, 2015; Spiranec, Zorica & Kos, 2016) and are generally referred to as information literacy (Quéau, 2001; Shibanda, 2006; Harle, 2010; Hart & Davids, 2010; Gakibayo, Ikoja-Odongo & Okello-Obura, 2013). For example, Gakibayo, Ikoja-Odongo and Okello-Obura (2013) report low use of e-resources at Mbarara University in Uganda despite abundant availability of such information resources at the institution, specifically because of low information literacy skills. The users' culture of doing research can be linked to IL and is a further factor contributing to the use of e-resources. IL is described as "a new frontier" by the director of UNESCO's Information Society Division (United Nations, 2001), which points to the fact that information literacy is often a "new" skill in certain environments. Apart from the studies already noted, several other studies also noted that limited information literacy skills can be a barrier to the use of available information resources (Drott, 2006; Ehikhamenor, 2003; Dadzie, 2005; Watts & Ibegbulam, 2006; Hart & Davids, 2010; Ajuwon & Olorunsaye, 2013; Gakibayo, Ikoja-Odongo & Okello-Obura, 2013; Bawden, 2014; Bhat & Mudhol, 2014; Mugwisi, 2014; Conway, 2015; Bhat & Ganaie, 2016).

Findings of Wozar and Worona (2003), Mbambo-Thata (2007), Jackson (2008), Rosenberg (2008), Research4Life (2009), Kandpal, Rawat and Vithal (2013), Bhat and Mudhol (2014), Bawden (2014) and Spiranec, Zorica and Kos (2016) indicate that appropriate training aimed at building user skills plays an important role in the adoption and use of information resources on the part of both users and librarians, who are the facilitators of information access at the universities. Training can be used to create awareness of types of e-resources available to users and to show them how to access the information. According to a study (Research4Life, 2009) on the use of the online resources (AGORA, HINARI, OARE and ARDI), awareness does not necessarily turn into use – users need to have the skills to use the available information resources effectively. This has also been noted in section 2.2. Hinson and Amidu (2006), Hoskins (2012), Kandpal, Rawat and Vithal (2013), Conway (2015) and Bhat and Ganaie (2016) support this point. At the universities studied in Ghana, Honduras, Tanzania, Uganda and Vietnam, many of the students did not have information literacy skills, as there was no formal training in information literacy in the student curriculum. Undergraduate and postgraduate students, academic staff, IT managers and librarians based at the universities participated in the study (Research4Life, 2009).

2.5.4 Electricity outages at institutions

Unreliable power is one of the main barriers to the use of e-resources and computers in developing countries, particularly in African countries (Dulle, 2015). Problems of unreliable electricity at tertiary institutions such as those in Nigeria, Uganda and Zimbabwe have been reported in several studies (Ehikhamenor, 2003; Musoke & Kinengyere, 2008; Rosenberg, 2008; Wema & Manda, 2011; Oyedapo & Ojo, 2013). Malapela (2014) reported that power outages at the GZU has had an impact on the library services offered at the university, especially access to e-resources.

The problem of unreliable power and power outages has frequently been cited as a challenge that frustrates researchers in their attempts to access and use e-resources in many

African countries (Oyedapo & Ojo, 2013; Dulle, 2015). For instance, in a study by Smith *et al.* (2007) that involved five African countries (Cameroon, Gambia, Nigeria, Tanzania and Uganda), it was revealed that power outages often interrupted the use of e-resources in the study areas. Similarly, Wema and Manda (2011) reported frequent power cuts as among the concerns of online information users in Tanzania.

Following the discussion in the preceding sections, it is necessary to consider the important barriers to e-resources, such as inadequate IT and internet infrastructure, limited bandwidth, high internet access costs and limited user skills when determining the level of adoption and use of e-resources at African universities. In the past decade private-public partnerships across the developed world have tried to address or mitigate the impact of some of these challenges (Oyedapo & Ojo, 2013; Malapela & De Jager, 2015) in order to promote the use of e-resources in developing countries, particularly at African universities.

2.6 ATTEMPTS TO IMPROVE ACCESS TO INFORMATION IN AFRICA

Several attempts have been made over the years to improve access to up-to-date scholarly information in developing countries (Dulle, 2015). Some efforts, such as the Research4Life and PERI schemes, have been targeted at universities and colleges in low-income countries. The schemes provide free or low-cost access to full-text journal articles to users in many Sub-Saharan countries, as already noted in section 1.2.6 and Table 1.1 (Rosenberg, 2006; Harle, 2009; Association of Commonwealth Universities, 2011; Ajiboye & Bankole, 2013; Gaible, 2015). They play an important role in improving access to scholarly publications for universities in developing countries.

Since the early 1990s there have also been many initiatives to bridge the digital divide between the haves and have-nots (INASP, 2003; Wu & Ochs, 2007; Harle, 2009; Association of Commonwealth Universities, 2011; Dulle, 2015).

As explained in section 1.7.7 and Table 2.4, there were also initiatives on open access. Open access implies broader access without institutional or technical constraints (Drott, 2006; Melero, *et al.*, 2014). Open access can be applied to all forms of published research, including peer-reviewed and non-peer-reviewed academic journal articles, conference papers, theses, book chapters and monographs. Open access journals are defined as journals that use a funding model that does not charge readers or their institutions for access. The DOAJ, an online directory that indexes and provides access to high-quality, open access, peer-reviewed journals, is a good example of this model.

Academic libraries have used consortia to purchase and access e-resources, especially journals and e-books, in order to contain publisher costs (Manda, 2005; Manda & Nawe, 2008; Association of Commonwealth Universities, 2011). Programmes such as the PERI by INASP helped academic and research institutions in Africa to form library consortia and negotiate deals with publishers in order to achieve low subscription rates.

The report by the Association of Commonwealth Universities (ACU) as part of a study commissioned by Arcadia (www.arcadiafund.org.uk) on the obstacles to accessing and using digital scholarly information in African universities noted that the availability of journals is no longer the principal problem. The greater challenge now is to ensure that what is available can be accessed and used to best effect. The study focused on four national research universities in East and Southern Africa: the University of Nairobi, Dar es Salaam University, the University of Rwanda and the University of Malawi (Chancellor College). They considered the "gold standard" of instant access to the latest issue of a journal, available free at the point of use.

For African universities, the types of initiatives continue to grow and can be grouped into three areas of focus: access, content, and skills building for librarians, information managers and users (Table 2.5). Some of these initiatives have already been noted in preceding sections. Thus only initiatives not mentioned before are noted here.

2.6.1 Initiatives addressing high subscription costs that have not already been noted

The main initiatives offering low-cost and free e-resources have been noted in preceding sections (1.2.6 and 2.4.3) and are discussed in more detail by Wu and Ochs (2007), Park *et al.* (2007), Hoskins and Stilwell (2010), the Association of Commonwealth Universities (2011), Berquist (2015), Malapela and De Jager (2015) and Coughlin, Campbell and Jansen (2016).

Table 1.1 covered initiatives offering free and low-cost access to scholarly publications. In addition, Table 2.5 captures the main initiatives to address the issue of high subscription costs. Information was sourced from the resources' listed websites available in January 2015.

Table 2.5 Scholarly access initiatives for Africa

Type	Initiative	Types of collections
Special low-cost contracts e-resources	• AJOL (www.ajol.org) • EIFL (www.eifl.org) • PERI (www.inasp.info) • PMC (www.pubmedcentral.nih.gov)	E-journals and e-books
Free access or open access resources	• Public Library of Science (www.plos.org/journals) • Open Journals Publishing (www.openjournals.net) • Free Electronic Journals (www.library.unr.edu/ejournals/free.aspx) • The Free Medical Journals (www.freemedicaljournals.com) • Information Research (http://informationr.net/ir)	E-journals
	• BioMed Central (www.biomedcentral.com) • Freebooks4doctors (www.freebooks4doctors.com)	E-books and e-journals
	• OER (www.oercommons.org)	Courseware

2.6.2 Offering open access journals

Open access is one of the initiatives addressing the problems of access. In addition to what was discussed in section 1.7.7, the following can be noted:

(1) Recognition

The main constraint on research reproduction and distribution, and the main role for copyright in the open access domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited (Young, 2002; Kling, 2004; Drott, 2006; Schöpfel & Prost, 2013; Rubel, 2014). It is important that authors acknowledge and cite relevant work appropriately and in an ethical way. This helps in accurately accounting and access and use measurement of available resources for scholars and researchers.

(2) A growing movement

The disappointment caused by "closed access" to scholarly literature (i.e. reader-pays), the anomalies in journal publishing paradigms in the areas of pricing, access and copyright, and a host of other monopolies all paved the way for an Open Society Institute meeting in 2001 that resulted in the Budapest Open Access Initiative, which led to the Open Access movement. Whether open access will reshape the fundamental nature of the long-established closed access model is still to be seen (Drott, 2006; Anbu, 2009; Kaser, 2009; Laakso *et al.*, 2011; Schöpfel & Prost, 2013; Laakso, 2014; Berquist, 2015; Wang, Liu, & Fang, 2015).

(3) Creative commons licence

All of the material available from these free initiatives is provided by the respective publishers or authors under the creative commons licence. Transmission, reproduction or reuse of protected material, beyond that allowed by the fair use principles of the copyright laws, requires the written permission of the copyright owners. Users are directly and solely responsible for compliance with copyright restrictions and are expected to adhere to the terms and conditions defined by the copyright holder (Kling, 2004; Drott, 2006; National Institute of Health, 2009; Wang, Liu, & Fang, 2015).

(4) Access to theses and dissertations

Institutional repositories are allowing African universities and research institutions to deposit and open up access to work such as theses and dissertations through open access initiatives (National Institute of Health, 2009; Schöpfel & Prost, 2013; Ifijeh, 2014; Laakso, 2014; Berquist, 2015).

2.6.3 How lack of skills affects use of e-resources

Low use of e-resource is sometimes linked to a lack of user skills. The argument is that concerted efforts to offer appropriate training plays an important role in addressing the skills issue in the case of academic staff and students (Agaba, 2004; Gathoni *et al.*, 2014; Abubakar & Adetimirin, 2015; Akussah, 2015; Akporhonor & Akpojotor, 2016). Information managers in libraries focus on the task of finding frequent opportunities and investments to create awareness of what information is available and how users can access and use the resources. They need to know how to create effective digital library services and how best to train their clients to use them. However, the information specialists themselves need training and appropriate training materials to achieve this (Griffiths, 2003;

Fisher *et al*., 2008: Chimwaza *et al*., 2010; Chimwaza, Chimalizeni & Chataira, 2011; Ajuwon & Olorunsaye, 2013; Gaible, 2015; Malapela & De Jager, 2015; Mugwisi, 2015; Singh, 2016).

2.7 SUMMARY

In summary, tertiary education is a critical pillar of human development worldwide, depending heavily on access to up-to-date scholarly information. Although much progress has been made in Africa, many challenges are found in the continent's tertiary institutions. Access to up-to-date scholarly information is one of the key challenges found at African tertiary institutions (Dulle, 2015).

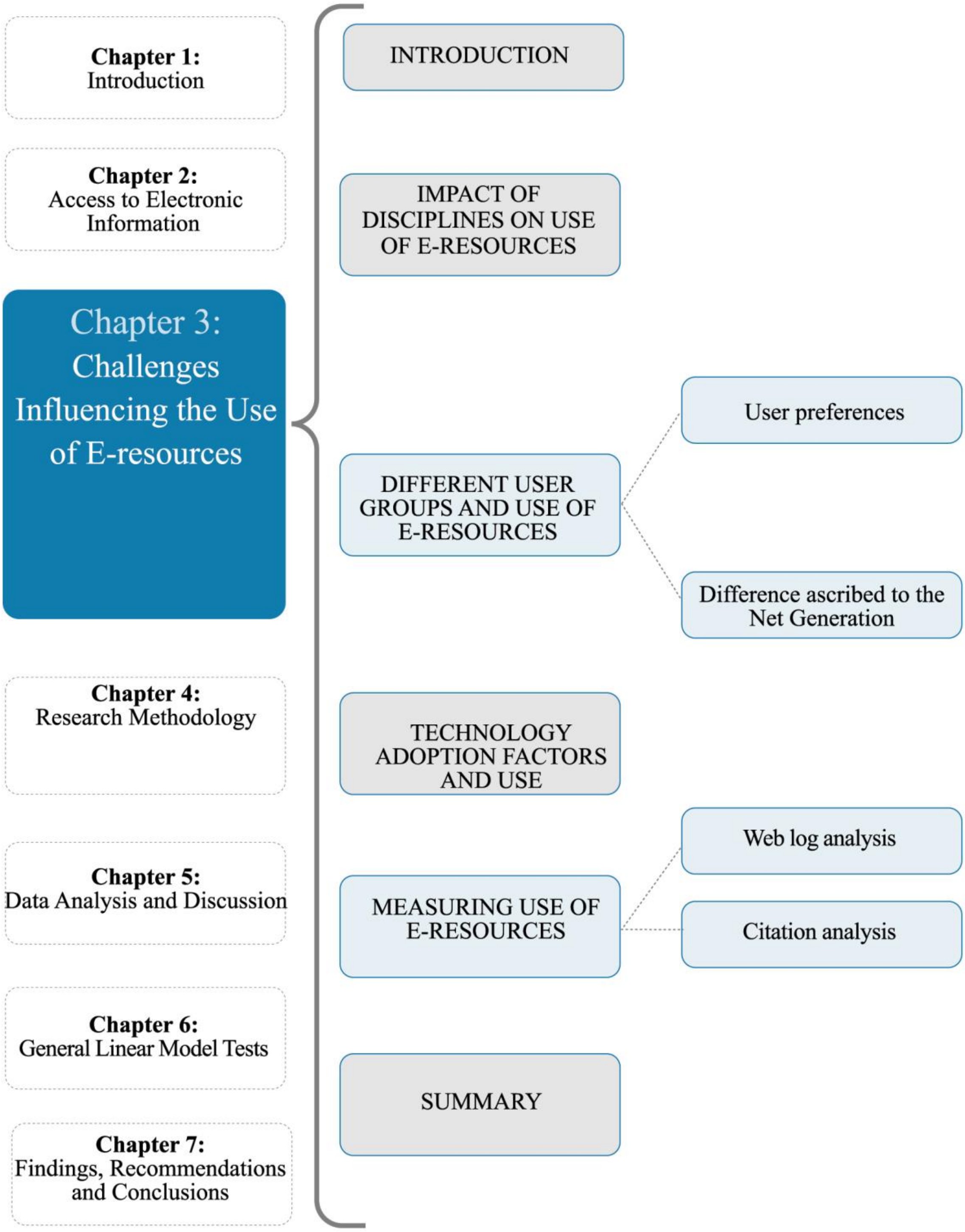
In general, the increased availability and accessibility of e-resources have contributed to an improvement in the dissemination of scholarly information. However, in developing countries and particularly in Africa, access to scholarly publications remains a challenge because of inadequate IT and internet infrastructure, limited and expensive bandwidth costs, limited access to computers and inadequate user skills. Several initiatives, such as Research4Life programmes (HINARI, AGORA, OARE, ARDI), PERI, DOAJ and TEEAL, have been started in the past decade to give free or low-cost access to scholarly e-resources, especially e-journals. However, the factors indicated in this chapter hamper the increased uptake and use of these initiatives at universities in developing countries.

Studies exploring the adoption and use of scholarly e-resources by students, scholars and academic staff in developing countries have appeared only recently. Much is still to be done to establish the factors affecting the use and non-use of these e-resources by users at African universities, especially since there are a number of initiatives addressing the issue of cost. The question remains: if these are the only factors, what could be done?

The following chapter explores the other factors influencing use and non-use of e-resources at universities. The focus is on the impact of disciplines on the use of e-resources, which has been reported to differ depending on the discipline and the level of adoption of technology by different user groups, to improve usage at universities in a developing country such as Zimbabwe.

CHAPTER THREE: CHALLENGES INFLUENCING THE USE OF E-RESOURCES

Chapter Overview



3.1 INTRODUCTION

As hinted at in the preceding chapter, libraries should ensure that their users have access to the information they require, and that they are able to access the information and use the information they obtain effectively. The issue of access to e-resources at African universities has been discussed in detail in Chapter 2 as a key factor to the use of e-resources. However, there are also other factors that affect the use or non-use of e-resources. These include the impact of different disciplines, user preferences, and the level of technology adoption by different user groups.

This chapter starts by discussing the impact of disciplines on the use of e-resources, which has been reported to differ depending on the discipline. Information-seeking behaviour and user preferences for e-resources at academic institutions are explained, difference of use ascribed to the Net Generation is considered, as is technology adoption factors and use by different user groups. The chapter ends by discussing techniques for monitoring the use of e-resources by way of transaction web logs and citation analysis. As in Chapter 2 discussion strongly features older references (the study started in 2009). Where appropriate, more recent literature and findings are incorporated.

3.2 IMPACT OF DISCIPLINES ON USE OF E-RESOURCES

Access to relevant and up-to-date information through e-resources at African tertiary institutions has seen access gradually improving in the past decade. The impact of different disciplines and different user groups on the use of library resources is an important aspect that also has a bearing on the use of e-resources (Hart, 1997; Lazinger, Bar-Ilan & Peritz, 1997; Mahe, Andrys & Chartron, 2000; Miller, 2014; Samson, 2014; Denny, *et al*., 2015).

Research has shown that the use of e-resources and other sources of information may differ according to the discipline. Different disciplines embrace e-resources at different rates, and rely on different types of networked information (Mahé, Andrys & Chartron, 2000; Talja & Maula, 2003; Tenopir *et al.*, 2003b; Fraiha, 2012; Tripathi & Kumar, 2014; Miller, 2014; Al-Suqri & Al-Aufi, 2015). Talja and Maula (2003) concur and add that earlier research on scholars' information-seeking patterns has shown major differences in the kinds of search strategies used in different fields. Park *et al.* (2007), Harle (2009) and Ajuwon and Olorunsaye (2013) assert that studies on information retrieval systems indicate that individuals with more sophisticated knowledge in the discipline know how to formulate more sophisticated and accurate queries and how to make more efficient use of databases to extract relevant information.

The impact of disciplines on information seeking and preferences for information sources can be monitored by different means (Samson, 2014; Denny *et al*., 2015). Measuring use is an important way to track the impact of a database, journal or article (Lazinger, Bar-Ilan & Peritz, 1997; Meho & Sugimoto, 2009; Tripathi & Kumar, 2014; Lawson, 2015). Measurement techniques like citation analysis, web tracking and authentication log analysis are examples of techniques that have been used in academic studies. These are discussed in section 3.5.

Edmond Gaible's (2013) studies focused on scientific, technological and medical sciences (health, environmental and agricultural disciplines) and highlight the increased use of e-resources by postgraduate students and researchers in universities in Ghana, Nigeria and Uganda. The study by Verma (2016) pointed to the use of e-resources by postgraduate students in humanities disciplines and their satisfaction level with the infrastructure to support accessing online database in in a university setting in Delhi.

3.3 DIFFERENT USER GROUPS AND USE OF E-RESOURCES

Getting the right information to the right user can pave the way for new directions in research and development (Kumar & Phil, 2009). It is imperative to achieve this objective that one should understand library users, how they interact with the system, their pattern of search and their pertinent information requirements (Pandey, 1992; Chaturvedi, 1994; Curtis, Weller & Hurd, 1997; Hart, 1997; Talja *et al*., 2007; Fisher & Julien, 2009). Arguably, lack of research on the user side of the information system adoption is in part responsible for underuse of information systems in developing countries (Park *et al.*, 2007).

Different users use library resources differently (Dadzie, 2005; Rosenberg, 2008; Talja *et al*., 2007; Soyizwapi & Hoskins, 2009; Denny *et al.*, 2015). In an academic context differences have been reported between groups such as academic staff, librarians and students (Joswick & Stierman, 1997). They differ in their level and patterns of use, and as noted, the disciplines in which they work also have an impact.

In a study conducted by Eason and colleagues at the Department of Human Sciences at Loughborough University in the United Kingdom from 1996 to1998 on the Super Journal application project (http://www.superjournal.ac.uk/sj) – a project designed to test the factors leading to the success of an electronic journal service – it was clear that a service to meet the requirements of users with varied patterns of use was needed (Eason, Richardson & Yu, 2000). The Super Journal consisted of 49 journals in four subject areas and was implemented with core functions of browsing, printing, searching and various value-added features. The Super Journal service was delivered to 13 UK institutions, which differed to varying degrees in size, culture, academic disciplines, technical infrastructure, geographical layout, etc. Eason, Richardson and Yu (2000) used K-Means cluster analysis to classify a spectrum of user behaviour with e-journals into a typology of eight types of users: the searcher, the enthusiastic user, the focused regular user, the specialised occasional user, the restricted user, the lost user, the exploratory user and the tourist (Eason, Richardson & Yu, 2000). The study showed that the contents (both coverage and relevance) and ease of use of a system, as perceived by the user, were the most significant factors affecting patterns of use. Users' perceptions of both factors were affected by a range of intervening factors such as discipline, status, habitual approach to information management, availability of alternative electronic journal services, purpose of use, etc. The study demonstrates the need for a service to meet the requirements of users with varied patterns (Liebscher, Abels & Denman, 1997; Eason, Richardson & Yu, 2000). Similar findings were noted by other studies, e.g. Kumar and Reddy (2016).

In the study by Miller (2014) looking at the use of e-resources by undergraduates and graduate cohorts at a large research university in Midwestern United States of America, database use varied by the schools or colleges in which students were enrolled. The School of Nursing had the highest proportion of database use with 56% of enrolled freshmen accessing the library databases. The College of Literature, Science and Arts had the fourth highest proportion of users at 46%, representing more than double the combined number of undergraduate users from all other programmes.

Contrary to other studies, e.g. Research4Life (2009), Harle (2010), Gaible (2013) and Mugwisi (2015), Miller (2014) conclude that database use patterns suggested that the proportion of students who continue to use library databases decreases as level of study progresses (i.e. from undergraduate to postgraduate studies).

This discussion will not dwell on studies reporting on undergraduate students since they are not part of the target group for this study.

In the Research4Life study of 2009 referred to earlier (see Chapter 2.3) on the use of the Research4Life programmes (AGORA, HINARI, OARE, ARDI) at selected universities in Ghana, Honduras, Tanzania, Vietnam and Uganda during 2008 and 2009, undergraduate and postgraduate students, academic staff, IT managers and librarians in charge of e-resources at the institutions took part. The findings showed that lecturers or professors, postgraduate and undergraduate students ranked barriers to the use of resources differently (Research4Life, 2009) (Table 3.1).

Table 3.1 Cited Research4Life programmes usage barriers

Factor	Lecturer or professor	Postgraduate student	Undergraduate student
Speed of internet	5	5	5
Lack of access to internet terminal	4	4	2
Competition for access with other users	3	3	3
Lack of assistance with using the specific e-resources	2	1	1
Cost of internet access	1	2	4

Participants had to rate the listed barriers (5 being very important and 1 being unimportant)

In the Research4Life (2009) study, while all three groups (professors, postgraduate and undergraduate students) cited internet speed as an important barrier to access to resources, they perceived other barriers differently. For instance, the cost of the internet was not as serious a problem for the professors as it was for students.

A study by Reinhold Treptow and Megan James (2011) titled "Use of online knowledge resources by prominent South African researchers" focused on understanding researchers' information search and securing preferences. Leading South African researchers were identified and invited to participate in a web-based survey to this end. Results indicate that e-resources are favoured for journal articles, but not for books, and researchers commonly employ chaining and browsing behaviour to locate relevant journal articles. Full-text journals are favoured by researchers to undertake searches. These are favoured over other bibliographic databases and other federated searches (Google, Google Scholar and MetaLib). Researchers used top journals found through Scopus and Web of Science citation databases. The findings also highlighted the importance of researchers making great use of these resources to locate relevant material.

In a study undertaken in 2003 to assess whether recent graduates of the Ohio State University's Occupational Therapy division were applying information-seeking skills learned as undergraduates (Powel & Case-Smith, 2003), a majority of the occupational therapy graduates who responded to the survey preferred to use information resources that were readily available, such as advice from their colleagues or supervisors and the internet, rather than the evidence available in journal literature. Fisher and Julien (2009) reiterate the same point as found in the studies of Powel and Case-Smith (2003). They note that at tertiary institutions' academic grants had little to do with a scholar's information-seeking and use practices; the best predictor of behaviour was his or her situation.

3.3.1 User preferences

A recent study by Egle *et al.* (2015)**,** focused on the use of e-resources by medical residents. A web-based survey was distributed to surgical residents in Michigan and third- and fourth-year medical students at an American allopathic and osteopathic medical school and a Caribbean allopathic school. The authors investigated the preferred sources of medical information in various situations. A set of 254 queries simulating those faced by medical trainees on rounds, during a written examination, or during patient care was developed. The top five e-resources cited by the trainees were evaluated for their ability to answer these questions accurately, using standard textbooks as the point of reference. The reported results indicated that respondents favoured a wide variety of resources. Most of the 73 respondents favoured textbooks or broad review books for prolonged studying, clinical decision-making questions and medical queries. The most commonly used e-resources were UpToDate, Google, Medscape, Wikipedia and Epocrates (Egle *et al*., 2014).

Another study by Samson (2014) at the University of Montana focused on the usage of e-resources by students and academic staff. The University of Montana is a graduate level research university and at the time of the study in 2012, 12 656 undergraduate and 2 290 graduate students were enrolled. The students were served by 840 academic staff and 1 560 support staff (Samson, 2014).

The focus of the study was to identify: 1) use of library e-resources by faculty and staff affiliation and status to identify research and teaching needs; 2) use of library e-resources by student's major subject, status, gender, registered disability and registered veteran status to establish best outreach practices and areas that need improvement of service and development of the collection in support of student learning; and 3) correlation between the use of library e-resources and student attainment as defined by grade point average (GPA) (Samson, 2014).

The findings conclusively document that students and academic staff use library e-resources to a statistically significant extent and that a statistical relationship exists between students' GPA and their use of e-resources. This information confirms the value of library resources to institutional teaching and research needs and can be used to document library value to the institutional mission (Samson, 2014).

Another study (Denny *et al.*, 2015) focused on health practitioners in Australia recently looked at the use of e-resources by medical general practitioner (GP) registrars. The study investigated GP trainees' use of e-resources and their preferences for sourcing clinical information to inform the prospective direction and design of e-resources for the GP education and training sector. A hundred and nineteen registrars completed an online survey measuring the type and frequency of use of e-resources, and preferences for their design and content. For the majority of registrars, e-resources were the first preference for obtaining clinical information (77.3%). The most frequently used e-resources were non-medical search engines, medical journals and prescribing software. Factors relevant to registrars' selection and use of e-resources included the accuracy and comprehensiveness of the information. The authors concluded that the use of e-resources provided a valuable supplement to registrars' learning and teaching. However, issues of quality and consistency raised some concerns regarding the use of e-resources for obtaining clinical information (Denny, *et al.*, 2015).

A study conducted in Nigeria (Ajuwon and Olorunsaye, 2013) in the health sector and already discussed in Chapter 2 reached similar findings. The study covered 12 tertiary health institutions in six states of Nigeria through a self-administered questionnaire. The findings of the 1 150 surveys filled in (a 64% response rate) show that a majority of the respondents (72.0%) were aware of HINARI, although 68% had used HINARI and only 35.1% had had formal training on how to use the resource (Ajuwon & Olorunsaye, 2013).

In the agriculture discipline an example is a study by Soyizwapi and Hoskins (2009). The purpose of this study was to investigate the use of electronic databases by postgraduate students in the Faculty of Science and Agriculture at the University of KwaZulu-Natal, Pietermaritzburg. The authors adopted a quantitative approach and a survey was conducted. The authors found that while postgraduate students used electronic databases, a few of the databases were not used. Postgraduate students experienced a number of problems when using the databases. Students became aware of the availability of electronic databases from a variety of sources, such as friends, library orientation programmes and academic staff. Search engines were identified as a resource that was very popular with almost all the students. The study revealed that there was a need for improving access to databases for all on-campus and off-campus users (Soyizwapi & Hoskins, 2009).

3.3.2 Differences ascribed to the Net Generation

The generation gap has been noted as important in the use of computers (Hargittai, 2010; Jones & Shao, 2011; Sherman, 2015), and seems important in general web user skills and the use of library e-resources. The Net Generation is the cohort of young people born between 1982 and 1991 who have grown up constantly exposed to computer-based technology (Prensky, 2001; Oblinger, & Oblinger, 2005; Sandars & Morrison, 2007; Sherman 2015). The key terms in this debate are the Net Generation and Digital Natives, but a growing number of competing terms are also used to identify new generations of young people who have been brought up in a digitally rich environment (Jones & Shao, 2011; Sherman 2015). The most common terms in circulation are the "Millennials" (Howe & Strauss, 2003), "Net Generation" (Oblinger, Oblinger & Lippincott, 2005; Kennedy *et al.*, 2007; Tapscott, 2009), "Digital Native/Digital Immigrants" (Prensky, 2010), and "Generation Y" (Jorgensen, 2003; Weiler, 2005; McCrindle, 2006; Mi & Nesta, 2006; Hargittai, 2010; Sherman 2015).

Several studies have been conducted in this regard (Tapscott, 1998; Howard *et al.*, 2001; Prensky, 2001; Oblinger, & Oblinger, 2005; Kennedy *et al.*, 2007; Sandars & Morrison, 2007; Hargittai, 2010; Cisco, 2014). As rightly argued by Oblinger (2003), Hargittai (2010), Jones and Shao (2011) and Cisco (2014), people who have grown up with digital media are often assumed to be universally knowledgeable about information and communication technologies. Such assumptions, however, are rarely grounded in empirical evidence (Prensky, 2001; Oblinger, 2003; Bennett, Maton & Kervin, 2008; Jones & Shao, 2011).

The Net Generation are generally marked by increased use and familiarity with communication, media, and digital technologies (Oblinger, 2003; Sandars & Morrison, 2007; Jones & Shao, 2011). Research findings indicate that this generation, are claimed to be very different from their predecessors in their familiarity with technologies and the regularity with which they use them (Oblinger & Oblinger, 2005; Sandars & Morrison, 2007; Kennedy *et al.*, 2007; Cisco, 2014).

As discussed in Chapter 2, the use and non-use of e-resources by academics point to the importance of building user skills by both undergraduate and postgraduate students of the Net Generation.

To accommodate the preferences of the Net Generation many academic libraries have reported the adoption of innovative methods to teach information literacy skills and library orientation, and to promote the use of library resources. A study by Sandars and Morrison (2007) surveyed first-year undergraduate students and found that a large majority started university with experience of using online systems such as blogs and wikis; further, their attitudes to the possible use of such tools in learning were positive. The study concluded that the Net Generation is a challenge to the way that all universities and medical schools provide teaching and learning. It recommends that all educators of this group of students be aware of incoming students' skills and experience and do more to promote the use of online systems in the undergraduate curriculum.

Innovations with interactive games have even been experimented with to enhance information literacy for the young generation (De Kock, 2008). De Kock argues that using game-based learning is effective, as the method has some Net Generation characteristics, such as the fact that play gets players intensely engaged in the activity. The young generation seems to grasp the concepts and logic and retain the sequences better than their elders. On the part of the older generation, there is sometimes unwillingness to learn new things and sometimes a phobia of computers because they did not grow up with them. This is consistent with the literature that asserts that both age (Cody *et al.*, 1999; Loges & Jung, 2001) and education (Howard, Rainie & Jones, 2001; Hargittai, 2005; Oblinger & Oblinger, 2005; Sandars & Morrison, 2007; Hargittai & Hinnant, 2008; Cisco, 2014; Sherman, 2015) are important predictors of varied internet use.

The results of a study conducted in the USA by Hargittai in 2007 at Northwestern University, were published in 2010. The study's population was the entire first-year college class of an urban public research university that is not the flagship campus of the state's university system (Hargittai, 2010). In 2007, a paper-pencil survey was administered in class to students in the one course on campus that is required for everybody, thus avoiding any selection bias as to who was enrolled in the class. The sample included 1 060 first-year students, the majority of whom were 18 or 19 years old. Just over half were women at 55.8%. Less than half of the sample was white and non-Hispanic at 42.7%. Asian and Asian-American non-Hispanic students accounted for 29.6% of respondents. Just under a quarter were Hispanic (18.8%), 7.7% were African-American non-Hispanic, and a few Native Americans took part in the study. The study findings refutes the belief that people who have grown up with digital media are universally knowledgeable about information and communication technologies. It finds difference in internet use based on socio-economic levels. Moreover, skill itself is positively associated with types of users (Hargittai, 2010).

Overall, members of the younger generation were reported to be able to use computers and manoeuvre their way through the complex functionality of today's computer applications and software faster than older generations. Cisco's recent study (Cisco, 2014) provides insight into the future of work as Generation Y professionals increasingly enter the workforce and as workers of all ages become more accustomed to mobile devices and working remotely (Cisco, 2014; Sherman, 2015). The key findings from the report indicate that:

- Most professionals use two to three work and personal devices in their daily lives;
- Most respondents believe their most important device in 2020 will be a smartphone;
- About two-thirds of professionals indicate they will conduct job searches across their countries.

The report is based on a study commissioned by Cisco to identify the technologies, such as mobility and collaboration, which could change the way people worked. Survey participants included:

- 1 388 Generation Y professionals between the ages of 18 and 30;
- 1 524 Generation X professionals between the ages of 31 and 50; and
- 827 HR professionals across a variety of industries.

The survey was conducted in 15 countries (Australia, Brazil, Canada, China, France, Germany, India, Japan, Mexico, the Netherlands, Poland, Russia, South Korea, the UK and the USA).

The study highlights the importance and use of mobile phones (specifically smart phones by professionals. The phones are used to connect remotely and search for information, which is covered by this study.

On the other hand, Kennedy *et al.* (2007) argue that although research has shown that Generation Y members are more comfortable with experiencing and learning by trial and error, traits that are important in learning to use computers, "the use of collaborative and self-publishing ‘Web 2.0’ technologies that have often been associated with this generation is quite low.” Several authors (Oblinger, & Oblinger, 2005; Bronstein & Aharony, 2009; Jones & Shao, 2011; Cisco, 2014; Sherman, 2015) argue that further research into technology user behaviour by Generation Y is needed in order to understand it better.

3.4 TECHNOLOGY ADOPTION FACTORS AND USE

Studies have also shown that the way users adopt new technologies and seek information has a significant bearing on how they use it. The following sections discuss this aspect in detail.

The issue of the impact of technology adoption determines how easily users adopt new technologies (Gefen & Straub, 1997; Fraiha, 2012; Wang *et al*., 2013; Al-Suqri & Al-Aufi, 2015). Everett Rogers (1983), a notable diffusion researcher, supports this view and states that a population can be broken down into five segments, based on their propensity to adopt a particular innovation: innovators, early adopters, early majorities, late majorities and laggards. Rogers’s work on diffusion of technologies confirms these processes and highlights that “diffusion is a process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995:35).

In addition, other studies carried out in the past decade at other institutions in Africa have shown that most of the non-users of e-resources were aware of the information and communication potential of the internet in their disciplines, and believed that the internet would become indispensable in their research in the future despite use being low at the time of writing (Ehikhamenor, 2003; Scott, 2005; Watts & Ibegbulam, 2006; Fisher *et al.*, 2008; Rosenberg, 2008; Ajuwon & Olorunsaye, 2013; Abubakar & Adetimirin, 2015; Akussah *et al.*, 2105). Fisher *et al.*, 2008 argue that despite continuing interest and ongoing investments in digital library systems for the facilitation of development efforts, research on individual-level factors that influence users’ acceptance of these systems has rarely been conducted. They further argue that insufficient research on digital libraries’ adoption dynamics raises critical questions, particularly when evidence indicates that information systems in developing countries have experienced high rates of failure.

Technology use and non-use can be influenced by a number of factors in different user groups (McCord & Ratnasingam, 2004; Fraiha, 2012; Wu, Lan & Lee, 2013). Various studies on technology use and adoption in academic contexts have been reported (e.g. Rogers, 1995; Park *et al.*, 2007; Brown, Letsididi & Nazeer, 2009; Shu & Chuang, 2009; Fraiha, 2012). Various factors influencing technology adoption has been noted: impact of attitudinal beliefs; normative beliefs and control beliefs (Brown, Letsididi & Nazeer, 2009; Zhou, Lu & Wang, 2010; Martín & Herrero, 2012; Chang *et al*., 2015).

It is important to understand these factors and identify their bearing on the adoption of new technologies (Brown, Letsididi & Nazeer, 2009; Zhou, Lu & Wang, 2010; Knight, 2013; Chang *et al.*, 2015).

Studies on adoption of IT have been influenced by many theories such as the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT), the theory of planned behaviour (TPB), and the diffusion of innovations theory (DOI) (Taylor & Todd, 1995; Parasuraman, McCord & Ratnasingam, 2004; Zeithaml & Malhotra, 2005; Premkumara & Bhattacherjee, 2008; Brown, Letsididi & Nazeer, 2009; Zhou, Lu & Wang, 2010; Martín & Herrero, 2012; Knight, 2013). Theories underlying technology adoption studies have often drawn from behavioural theories, such as the theory of planned behaviour.

Technology acceptance by users has a major bearing on the uptake and use of new technologies and this also applies to access to and use of e-resources, which is the focus of this study.

For every new technology there are general factors that affect its adoption by intended users. Scholarly e-resources are no exception (Miller & Khera, 2010; Cisco, 2014). Studies in information systems have investigated the phenomenon of the adoption of new technology (Rogers, 1995; Park *et al*., 2007; Brown, Letsididi & Nazeer, 2009; Wu, Lan & Lee, 2013; Chang *et al*., 2015).

The technology acceptance model (TAM) put forward by Davis (1985) and Zhang, Guo and Chen (2008) addresses IT adoption, implementation and diffusion in terms of perceived ease of use and perceived usefulness. Gefen and Straub (1997) and McCord and Ratnasingam (2004) suggest that belief about the system, perceived use and perceived ease of use directly affect attitudes to use. However, a limitation of the TAM is that the model excludes the influence and personal control factors on behaviour (McCord & Ratnasingam, 2004; Zhang, Guo & Chen, 2008; Cisco, 2014).

In addition to the findings noted for studies of technology use and adoption, the application of theories can shed further light. Theoretical frameworks such as TAM, UTAUT, TPB and DOI have revealed the impact of (1) attitudinal beliefs (including relative advantage, compatibility, perceived ease of use, prior experience, perceived risk and status gains); (2)

normative beliefs (the influence of friends and family, secondary sources' influence and workplace referents' influence); and (3) control beliefs (self-efficacy, costs, support, service and knowledge) (Brown, Letsididi & Nazeer, 2009; Wang & Shih, 2009; Martín & Herrero, 2012). These categories also apply to the library e-resources environment.

From studies of technology use and adoption and theoretical frameworks (Davis, 1986; Rogers, 1995; Gefen & Straub, 1997; McCord & Ratnasingam, 2004; Brown, Letsididi & Nazeer, 2009; Fraiha, 2012; Al-Suqri & Al-Aufi, 2015), two were particularly useful for the planning of this study. A study by Miller and Khera (2010), examined features that inform user acceptance of the implementation of a digital library system at agricultural universities in two developing countries: Kenya and Peru. They applied a TAM framework. This study examines not only factors contributing to the adoption of this offline digital library, but also a cross-site comparison, meant to examine the functionality in the developing world of a theoretical model developed in and based on conditions in the developed world.

The study found that the TAM worked well in describing factors that affect the use of digital libraries in developing countries, with perceived usefulness the main predictor of intent to use this system (TEEAL), and with relevance the main driver of perceived usefulness. Overall, the study found particular predictors of perceived usefulness and perceived ease of use that are consistent across cultures (relevance, trust, and ease of access), while other constructs (social norms, domain knowledge, visibility and self-efficacy) demonstrated predictive power in only one setting. While *post hoc* analyses gave several clues as to drivers of these differences, the TAM cannot definitely address what causes differences in predictive power between sites. However, according to the results it was clear that application of the TAM to IT implementation in developing countries must be guided by the specificities of local circumstances rather than by the performance of the TAM in highly developed countries.

3.5 MEASURING USE OF E-RESOURCES

There are many ways to study the use of e-resources (Leckie, 1996; Samson, 2014; Tripathi & Kumar, 2014; Pons *et al.*, 2015). Citation analysis, web tracking, authentication log analysis are examples of techniques that have been used in measuring the use of e-resources.

3.5.1 Web log analysis

Transaction log analysis, especially analysis of search and retrieval counts and search strategies, has a long history as an analytic technique in bibliometrics (Kaske, 1993; Fourie & Bothma, 2007). Transaction log analysis (also known as log analysis, log file analysis, or log tracking) has been used to monitor the use of databases, CD-ROM software and library catalogues (OPACs) (Fourie & Bothma, 2007; Miller, 2014).

Transaction web logs and citation analysis are some of the commonest ways of measuring the use of electronic resources (Moed, 2005; Fourie & Bothma, 2007; Polydoratou, Pendleton & Nicholas, 2007; Miller, 2014; Prakash & Jaya, 2016; Sisodia, Khandal & Singhal, 2016). Kaske (1993), Hoskins and Stilwell (2010) and Malapela and De Jager (2015) state that librarians, faculty and university administrators use e-resources usage statistics for many practical applications: to begin or end subscriptions, to justify budget allocations, to prioritise research areas, programmes and education, and to seek funding. Publishers are beginning to price e-journal and database subscriptions, for example, according to the number of articles retrieved from them, giving librarians more reason to develop critical analytical tools regarding online resource usage (Kaske, 1993; Hoskins & Stilwell, 2010; Lawson, 2015; Cassell, 2016).

On the other hand, it is important to note, as argued by Polydoratou, Pendleton and Nicholas (2007) and Savant, Bhattacharyya and Kim (2016) that the limitation of transactional web logs, in general, is that they record the IP address of the computer that accessed the web site. That is not necessarily linked to a particular user. Therefore, results are presented as actual access numbers rather than human beings (Polydoratou, Pendleton & Nicholas, 2007; Miller, 2014). Subscription renewals in academic and research libraries depend on these counts (Hoskins & Stilwell, 2010; Lawson, 2015; Prakash & Jaya, 2016).

Web log transactions provide rich data and facilitate the measurement of hourly, daily and weekly use of digital resources such as e-journals, e-books and online databases (Covey, 2002; Polydoratou, Pendleton & Nicholas, 2007; Lawson, 2015; Savant, Bhattacharyya & Kim, 2016). In addition, they collect information about the domains (the countries), the referrers (the sites that directed computers to the services) and the requested files that were downloaded. They enable the monitoring of the use of the individual directories' services from which the requested files were downloaded. Further, according to Covey (2002), Nicholas, Huntington and Watkinson (2005) and Savant, Bhattacharyya and Kim (2016), they give access to technical information of the computers that accessed services such as browser types, operating systems and file types downloaded. Several studies have reported on web log transactions, e.g. Hoskins and Stilwell (2010), Tripathi and Kumar (2014), Lawson (2015), Pons *et al.* (2015), and Prakash and Jaya (2016). A study important for the planning of this empirical study was one by Polydoratou, Pendleton and Nicholas (2007) at the Environmental Protection Agency (EPA) in the UK on the EPA's Environmental Data Registry (EDR)[6] used the web logs to track the level of use of the database. The paper presented findings on the use of the EDR metadata registry system based on data from web log transactions and an analysis of web log transactions of a six-year period (1998-2004). The findings presented the daily, monthly and yearly use of the EDR. It showed trends in its use over the six years and identified some of the metadata registry's users and the information they sought (as shown in the directory reports) (Table 3.1).

Focusing on 24 Digital Library Federation member libraries, Covey (2002) conducted 71 interviews with library professionals engaged in the assessment. The report describes the application, strengths and weaknesses of assessment techniques that include surveys, focus groups, user protocols and transaction log analysis. Covey's 2002 report, titled **"**Usage and usability assessment: Library practices and concerns details", describes a survey of the methods deployed at selected digital libraries to assess the use and usability of their online collections and services. Covey concluded that libraries also want digital library use statistics to be comparable with traditional use statistics. For example, they want to count virtual visits to the library and combine this information with gate counts to get a complete picture of library use. Tracking virtual visits is difficult because in most cases, library website and local digital collection use is not authenticated. Authentication automatically associates transactions with a user session, clearly defining a "visit." In an unauthenticated environment where transactions are associated with IP addresses and public computers are used by many different people, perhaps in rapid succession, defining a visit is not easy (Covey, 2002). Studies by Polydoratou, Pendleton and Nicholas (2007), Tenopir (2009) and (Cassell, 2016) support this point.

Concerns have been noted that librarians still need to improve their methodological and data analysis skills. Tenopir, *et al.* (2003), Lewellen and Plum (2016) and Cassell (2016)

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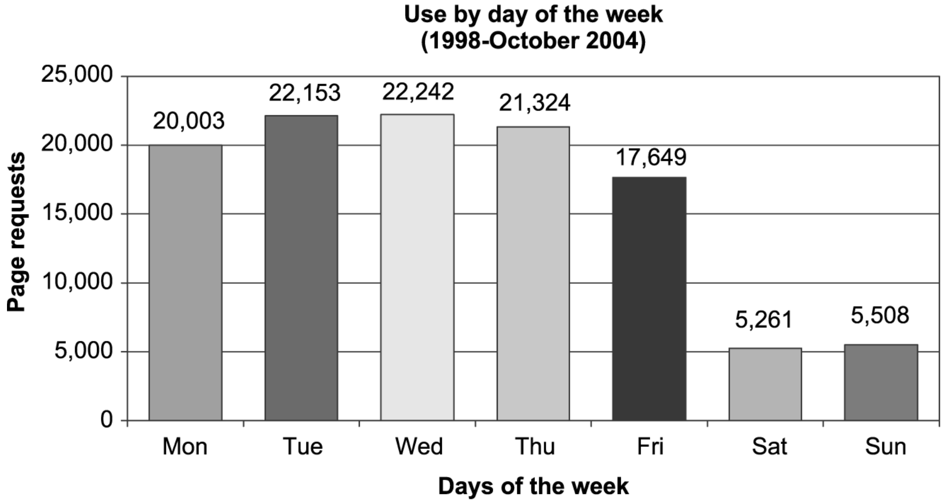
[6] The Environment Data Registry is a source of reference information about the definition, source and uses of environmental data published by the Environmental Protection Agency (http://iaspub.epa.gov/sor_internet/registry/sysofreg/home/overview/home.do)

note the need for guidance in analysing and managing transaction log data in order to standardize the procedures.

On the other hand Tannery *et al.* (2002) and Xie (2008) argues that there is a lack of users' involvement in determining e-resources use evaluation criteria and associated variables. In order to gain a complete picture of users' assessment and use of e-resources, there should be an active engagement of users in every aspect of e-resources evaluation, from defining e-resources evaluation criteria, to their uses, and their assessment.

Figure 3.1 Example of Using Web Logs Transaction – Use of the EDR by day[7] of the week



In the example given in Figure 3.1 the variable, access use, is a measure of local online journal use derived from transaction log counts of the two main routes by which users accessed online journals. One use measure, total annual links followed from the library's alphabetic online journal list, can be combined with a second measure, total annual Open URL resolver links by journal. The two measures are mutually exclusive, since a user could access online journals through the library web page or the Open URL resolver, but not through both at the same time. While neither measure indicates that any particular article from any given journal was actually downloaded, printed, or used, they are roughly the online equivalent of *print use*, simply indicating that a user was interested in accessing the particular journal for some reason.

Libraries can use weblogs to quantify the use and value of serial subscriptions (Lawson, 2015); and justify investments (Malapela & De Jager, 2015; Coughlin, Campbell & Jansen, 2016). At the time of writing, full-text downloads were the most commonly reported

[7] Source: Polydoratou, Pendleton & Nicholas (2007:85)

measure of article use in the industry despite issues concerning its consistency and commonality (Lawson, 2015; Coughlin, Campbell & Jansen, 2016).

Coughlin, Campbell and Jansen (2016) evaluated cost and use of electronic resources in order to provide meaningful analytics. They examined a subset of journals from a large research library using a web analytics approach with the goal of developing a framework for the analysis of library subscriptions. This foundational approach is implemented by comparing the impact to the cost, titles, and use for the subset of journals and by assessing the funding area. Overall, the results highlighted the benefit of a web analytics evaluation framework for university libraries and the impact of classifying titles based on the funding area. Further, they show the statistical difference in both use and cost among the various funding areas when ranked by cost, eliminating the outliers of heavily used and highly expensive journals.

The study highlights the need for future studies aimed at refining this model for a larger scale analysis tying metrics to library organisational objectives and for the creation of an online application to automate this analysis.

Measuring usage is an important way to track the impact of a database, journal or article (Tripathi & Kumar, 2014; Lawson, 2015). The article by Tripathi and Kumar (2014), titled “Use of online resources at Jawaharlal Nehru University: A quantitative study”, describes the findings on the use of e-resources at Jawaharlal Nehru University, which are offered through the University Grant Commission – Information and Library Network (UGC-INFONET) consortium. Statistical techniques are applied to usage reports generated by e-resource vendors or publishers to understand trends and seasonality in the usage of e-resources in academic libraries. The researchers evaluated the gain in popularity of e-resources and compared the use of various databases of e-resources by volume of downloads over three years. The cross-comparison of databases helps identify e-resources that have been optimally used.

The study used the quantitative approach to express the utilisation of e-resources by number of downloads of full-text research papers from Project Muse, Cambridge University Press, Oxford University Press, Springer Links, Taylor and Francis and JSTOR databases, accessible through the UGC-INFONET consortium. The investigation is based on secondary data of usage statistics made available by the UGC-INFONET consortium for the period 2008 to 2010 (Tripathi & Kumar, 2014).

Overall the findings indicated that e-resources have been gaining popularity gradually in academic libraries; this trend is in tune with the higher popularity of web-based intellectual resources in other sectors. The study established the need for a library consortium for sharing resources and subscription fees. The investigation proved a significant association between the number of downloads of e-resources from different databases in the same period; thus the gain in popularity of one database encourages readers to explore other databases. The study indicates the seasonality effect in the use of e-resources in academic libraries. This seasonality effect is contemporary to the academic calendar. There are large numbers of downloads just before the examinations, which are held twice a year, and a negligible number of downloads during and around long summer study breaks. Thus, the bandwidth rendered to the university is not consistently used during the academic session. The coverage of databases by disciplines and number of journals varies to a great extent. There is overlapping in the coverage of databases. The strength of students and their demands for scholarly works also varied across disciplines, thus cross-comparison of numbers of downloads from databases has little meaning until the impact of these three parameters has been controlled in the investigation of the use of e-resources **(**Tripathi & Kumar, 2014)**.**

3.5.2 Citation analysis

According to McDonald (2006), Simko (2015), Todeschini and Baccini (2016) and Thelwall (2016) citation analysis is the standard methodology for studying and monitoring journal use in information science. Since the Institute for Scientific Information (ISI) published the first citation indexes (Garfield, 2005), researchers in information science have developed numerous methods for studying how, why, and how often authors cite research articles. Citation analysis is a methodology that many proponents view as a vital research area in the field. Some researchers have reported that it is a valuable tool that allows librarians to evaluate journal quality, researcher productivity and journal use (Northwestern University Library, 2014; Condic, 2015). In fact, it is one of the few methods developed in library and information science to be used widely in other fields (Borgman & Furner, 2002; Condic, 2015; Simko, 2015). However, other recent studies have found varied results, Simko (2015), Thelwall (2016). Ivan Simko (2015) highlights citation bias in his report titled “Analysis of bibliometric indicators to determine citation bias”. Simko (2015) argues that choice of experimental subject significantly influences citations of research papers.

The value of citation analysis include that it is highly quantifiable, easy to collect and can be evaluated (Sylvia & Lesher, 1995; Borgman & Furner, 2002; McDonald 2006; Simko, 2015; Thelwall, 2016).

Criticisms include the differences in discipline focus (Simko, 2015); problems of uncited articles (MacRoberts & MacRoberts, 1989; Thelwall, 2016; Todeschini, & Baccini, 2016); issues of biased citing (citing the secondary source instead of the primary source); informal influences not being cited (conversations, communications); self-citing, positive or negative citations, and clerical errors (MacRoberts & MacRoberts, 1989; Haycock, 2004; Condic, 2015).

Usage analysis, in contrast to citation analysis, is an emerging area of bibliometric research (Borgman & Furner, 2002). Issues concerning the analysis of online journal usage statistics have lately come to the forefront of library and information studies research (Anyaoku & Anunobi, 2014; Condic, 2015; Simko, 2015; Thelwall; 2016). Work on developing standards on the collection and reporting of online journal statistics continued to develop at the time of writing these studies (Project Counter, 2002; McDonald, 2006; NISO, 2014; Simko, 2015; Thelwall, 2016).

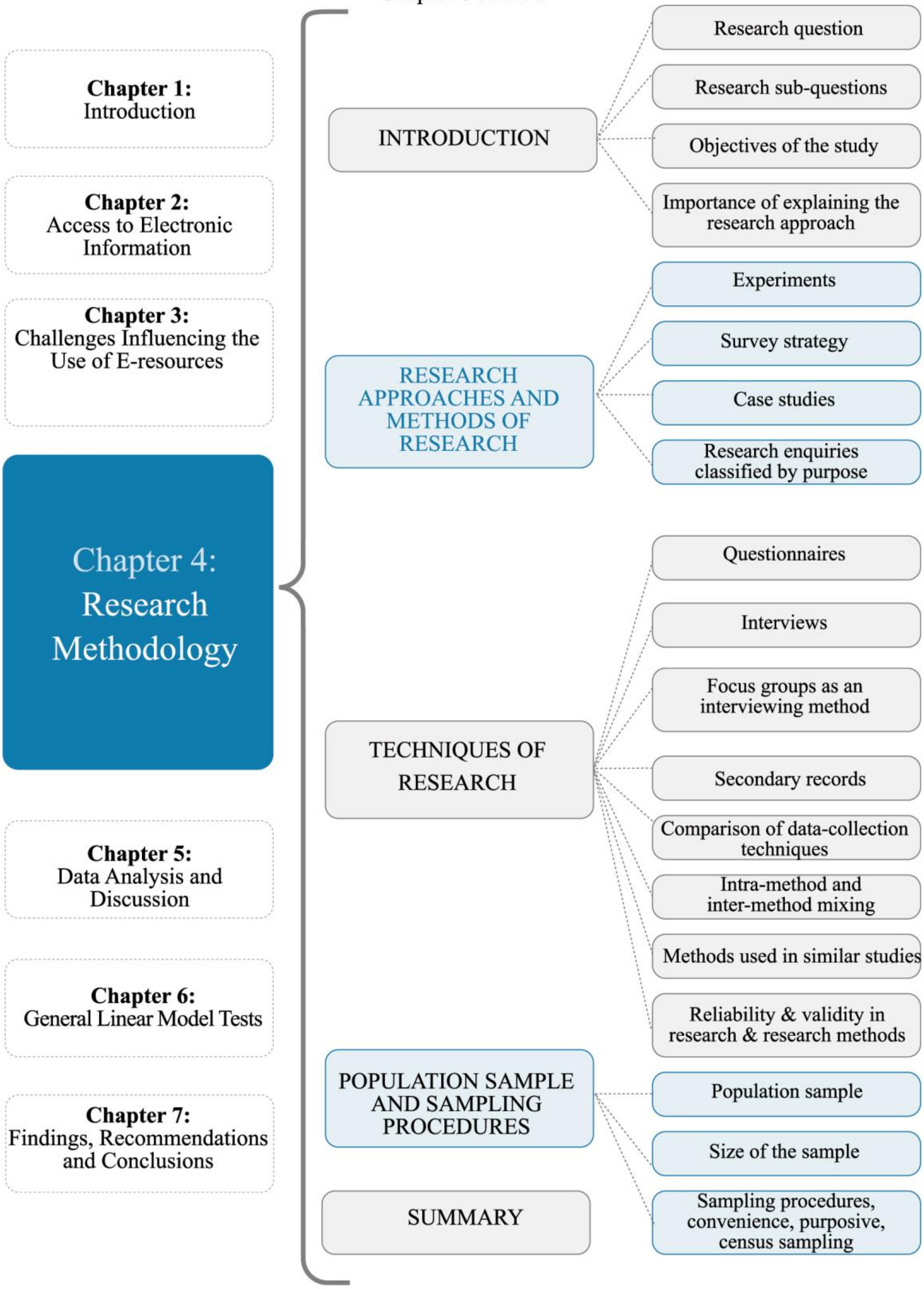
3.6 SUMMARY

While libraries are making an effort to establish measures to improve access to information at African universities and colleges, many challenges in this regard have not been addressed. In addition to the issue of access to e-resources at African universities and colleges, dealt with in Chapter 2 as key to the use of e-resources, this chapter established the impact of different disciplines, the impact of different user groups including the Net Generation, and the impact of the adoption of new technologies as important factors that also affect the use or non-use of electronic information at the institutions. Problems of information-seeking behaviour, user preferences and different patterns of use by different user groups are some of the additional challenges that were established and will need to be addressed if the adoption and use of information resources at universities and colleges in Africa are to improve.

The findings of chapters 2 and 3 will be used to understand the existing knowledge of factors affecting the use and non-use of e-resources and to plan data collection for this study. This research will add new knowledge in establishing the key factors affecting the use and non-use of e-resources by postgraduate and academic staff at universities in Zimbabwe, with special focus on free and low-cost e-resources.

CHAPTER FOUR: RESEARCH METHODOLOGY

Chapter Overview



4.1 INTRODUCTION

Chapter 4 discusses the collection of data to answer the principal and subsidiary research questions of the study. It explains the research design, methods of research, techniques of research, population sample and sampling techniques and the data-collection methods employed. It also discusses data analysis and articulates the issues of data quality, reliability, triangulation and validity.

4.1.1 Research question

The research question directing this study was stated in Chapter 1, and is repeated here to contextualise the discussion of the research design and research methods. The data collected for the study seek to answer the research question: **What are the factors affecting the use of free and low-cost library e-resources by academic staff, information specialists and postgraduate students in STM disciplines at universities in Zimbabwe?**

4.1.2 Research sub-questions

To address the main research question, data were collected in order to answer the following sub-questions (these were also stated in Chapter 1):

i. What is the *status quo* of free and low-cost e-resources available at universities in Zimbabwe?
ii. What has been reported about the use of free and low cost e-resources and information behaviour in this regard, especially concerning developing countries?
iii. What has been reported on the improvement and encouragement of the use of free and low cost e-resources in developing countries?
iv. Which factors are influencing academic staff, postgraduate students and information specialists' *access* to e-resources in STM disciplines at universities in Zimbabwe?
v. Which factors are influencing academic staff and information specialists' *use* of e-resources at Zimbabwean universities in the STM disciplines?
vi. How can the use of e-resources at universities in Zimbabwe be effectively promoted in order to increase the use of these resources by academic staff and information specialists at these universities?

The empirical study for which the methodology is discussed in this chapter seeks to address Questions (i), (iv) and (v), while Questions (ii) and (iii) are addressed under the literature analysis in Chapters 2 and 3. Recommendations (vi) are addressed in Chapter 7.

4.1.3 Objectives of the study

The objectives of the study were also stated in Chapter 1 and are repeated here to contextualise the discussion on the research methodology. The objectives are:

- Establishing the factors contributing to the access, use and non-use of free and low-cost e-resources by academic staff, information specialists and postgraduate students in STM disciplines at five universities in Zimbabwe.
- Recommending policy and guidelines to promote the use of e-resources and the improvement of IL training to support the use of these databases at the universities.

4.1.4 Importance of explaining the research approach

In order for studies to be replicated, and in order to judge the reliability of a study, it is important to explain the research methodology. Without this replication of statistically significant results, the research would not satisfy all the requirements of testability (Shuttleworth, 2008). The following section explains in detail the research methodology employed**.**

4.2 RESEARCH APPROACHES AND METHODS OF RESEARCH

As noted by Moahi (2002), research in information science often demands a combination of qualitative and quantitative methods, because information and issues related to information transcend the qualitative-quantitative dichotomy.

In quantitative approaches the researcher’s role is that of an objective observer and studies are focused on specific questions or hypotheses that ideally remain constant throughout the investigation (De Vos *et al.*, 2004; Wisker, 2007). Quantitative measures are about “the study of things by the use of mathematical and statistical methods” (Booth, 1988:48). De Vos *et al.* (2004) further argue that in a quantitative approach measurements are focused on specific variables that are quantified through rating scales, frequency counts and other means. Struwig and Stead (2001) assert that quantitative research is described as research that involves numbers and measurement, thus emphasising frequencies and statistics.

On the other hand, a qualitative methodology is based on the assumption that valid understanding can be gained through accumulated knowledge acquired at first hand by a single researcher or group of researchers (Mouton & Babbie, 2001; De Vos *et al.*, 2004). The researcher attempts to gain first-hand, holistic understanding of phenomena and data collection is shaped as the investigation proceeds. The methods for quantitative and qualitative research will be dealt with in more detail in the sections to follow.

Although both quantitative and qualitative measures are employed, this study primarily takes a quantitative approach.

A research design is defined as a plan that guides the investigator in the process of collecting, analysing and interpreting observations (Yin, 1994). It is a logical model of proof that allows the researcher to draw inferences concerning causal relations among the variables under investigation (De Vos *et al.*, 2002; Yin, 2004; Outhwaite & Turner, 2007). The research design is the plan, recipe or blueprint for the investigation, and as such provides a guideline according to which a selection can be made of which data collection methods will be most appropriate for the researcher's goal and for the selected design (De Vos *et al.*, 2002). Punch (2005:72) identifies four issues in particular as being the crux of research design: the research strategy, the conceptual framework, the unit(s) of analysis, and the data collection and analysis techniques to be employed.

Traditionally, three research strategies, i.e. experiments, case studies and surveys, have commonly been used in the social sciences. Each has its advantages and disadvantages (Robson, 1994; Wisker, 2001; Outhwaite & Turner, 2007; Monette, Sullivan & DeJong, 2013), as discussed in the following sections. Robson (1994) and Wisker (2001) further argue that hybrid strategies can also be used successfully, for example combining a case study approach with a survey, depending on the purpose of the enquiry. The research design also covers sampling techniques, discussed in section 4.3.

As discussed in section 3.4 the literature review established that the Technology Adoption Model (TAM) framework was reported to be effective in reviewing factors that affect the use of digital libraries. An example was a study on the TEEAL (The Essenital Electronic Agricultural Library) project by Miller and Khera (2010) using the framework. According to the results it was clear that application of the TAM to IT implementation in developing countries must be guided by the specificities of local circumstances rather than by the performance of the TAM in highly developed countries (Davis, 1985; Zhang, Guo & Chen, 2008; Miller & Khera, 2010). It was therefore decided not to use the model for this study and therefore the application of the framework will not be discussed further.

4.2.1 Experiments

Experiments entail measuring the effects of manipulating one variable against another variable (Robson, 1994; Struwig & Stead, 2001; Outhwaite & Turner, 2007). These studies are usually quantitative in nature and aim to provide a causal study of a small number of cases under highly controlled conditions (Mouton & Babbie, 2001; Struwig & Stead, 2001;

Outhwaite & Turner, 2007). High control is achieved through laboratory conditions. The possibility of causal inference derives from the use of randomisation techniques, experimental and comparison groups and repeated measures over time (Mouton & Babbie, 2001).

As Monette, Sullivan and DeJong (2013) further explain, experimental design is a controlled method of observation in which the value of one or more independent variables is changed to assess the causal effect on one or more dependent variables. Struwig and Stead (2001) and Outhwaite and Turner (2007) concur, and add that among the quantitative explanatory research strategies, the experiment is often considered the gold standard; however, as Punch (2005:94) notes, many important inquiries in social research – and this is true of this study – cannot be studied experimentally.

The strength of using experimental design is the ability of the researcher to infer causality and test causal relationships (Saslow, 1982). However, the limitations are that small sizes make generalizability risky and laboratory settings, especially in the human sciences, create their own artefacts and errors, which also limit the external validity of findings (Mouton & Babbie, 2001). For the purpose of this study there is no need to go into more detail on this type of design, as this method is not used in this study.

4.2.2 Survey strategy

The survey strategy generally constitutes two central features (Saslow, 1982; Robson, 1994):

- The collection of a small amount of data in standardised form from a relatively large number of individuals; and
- The selection of samples of individuals from known populations.

Bryman (1992) explains that survey research entails the collection of data on a number of units and usually at a single juncture in time, with a view to collecting systematically a body of quantifiable data in respect of a number of variables which are then examined to discern patterns of association.

Surveys entail the collection of information in standardised form from groups of people (Saslow, 1982). Surveys are often cross-sectional studies. They are usually quantitative in nature and aim to provide a broad overview of a representative sample of a large population

(Mouton, 2001). The instrument of observation is usually a questionnaire or structured interview (Saslow, 1982; Mouton & Babbie, 2001; Struwig & Stead, 2001; Bryman, 2007).

A randomised cross-sectional survey design is one of two designs that are commonly used with surveys as a data-collection method (De Vos *et al.*, 2002). The first step is to identify the research population, whereafter interviews and questionnaires can be used to collect data.

In replicated randomised cross-sectional surveys, surveys of a particular population are repeated over selected time periods. For each survey a new representative random sample is drawn (Saslow, 1982).

The results of surveys are used to summarise the characteristics of different groups of people or to estimate their feelings and attitudes about issues (Saslow, 1982; Mouton & Babbie, 2001; Struwig & Stead, 2001). The strength of surveys is that one has the potential to make inferences and generalise findings to large populations if appropriate sampling design has been implemented (Mouton & Babbie, 2001; Bryman, 2007).

It is also important to note the limitations of surveys as lack of depth and the possibility that an insider perspective can result from surface-level analysis. Another point is that survey data are sometimes very sample- and context-specific, e.g. in public opinion polls (Mouton & Babbie, 2001).

Hence, as rightly stated by Bickman and Rog (2009:375) and true for this study, the quality of data from a survey depends on the size and representativeness of the sample from which data are collected, the techniques used for collecting the data, the quality of interviewing (if interviews are used), and the extent to which the questions are a good measure of the issue(s) under study.

4.2.3 Case studies

Case studies entail the development of detailed, intensive knowledge about a single case or a small number of related cases (Saslow, 1982; Mouton & Babbie, 2001; De Vos *et al.*, 2002). Mouton en Babbie (2001) further argues that case studies are usually qualitative in nature and they aim to provide an in-depth description of a small number of cases. However, as noted by Saslow (1982), although case studies can offer in-depth insights, they by themselves are not a dependable source of information, as the results tend not to be generalizable – a limitation also noted by Jersild and Meigs (1939) and Mouton and Babbie (2001). This is because frequently researchers present after-the-fact conclusions rather than summarise findings and observations systematically. It is therefore important to note that "case studies by themselves are a weak support for scientific conclusions", since they are based on such limited observation (Saslow, 1982:12). The case study method is not used in this study.

4.2.4 Research enquiries classified by purpose

The choice of method of research can also be influenced by the purpose of the enquiry (i.e. the reason for the research). As stated by Robson (1994), Punch (2005) and Outhwaite and Turner (2007), research can be classified in terms of the purpose as well as by the research strategy used. A tripartite classification is commonly used, distinguishing between exploratory, descriptive and explanatory purposes for case studies (Robson, 1994; Struwig & Stead, 2001; Outhwaite & Turner, 2007). Other authors, such as Wisker (2001), add predictive and action classes to the above-mentioned three classes.

Although a particular study may be concerned with more than one purpose (even all three), one often dominates (Robson, 1994; Mouton & Babbie, 2001; Wisker, 2001). These classes of purposes provide researchers with a way of defining their aims and outcomes and of clarifying the strategies adopted in studies (Outhwaite & Turner, 2007).

Descriptive research aims to find out more about a phenomenon and to capture it in detailed information (Wisker, 2001; Outhwaite & Turner, 2007). Often the capturing and description are only true for that moment in time, but still help researchers to understand the phenomenon and know more about it. Exploratory research asks both "what" and "why" questions, and is commonly used when new knowledge is sought or certain behaviour and the causes for the presentation of symptoms, actions, or events are to be determined (Struwig & Stead, 2001; Wisker, 2001). While explanatory research also asks "why" questions, it specifically looks at the cause-effect relationships between two or more phenomena (Saslow, 1982; Mouton & Babbie, 2001; Wisker, 2001; Bryman, 2007). Explanatory research can be immensely helpful when description and simple exploration have come up with a number of variables that confuse rather than clarify the assumptions and hypotheses (Wisker, 2001; Outhwaite & Turner, 2007).

According to Robson (1994:123), generally:

- Case studies are appropriate for exploratory work;
- Surveys are appropriate for descriptive studies; and
- Experiments are appropriate for explanatory studies.

A descriptive survey is used in this study. Descriptive survey designs result in a description of the data, whether in words, pictures, charts or tables (Bryman, 1992; Punch, 2005). Limited inferential statistical analysis is, however, also applied to the data.

4.3 TECHNIQUES OF RESEARCH

There are five common types of data collection, of which four are considered in more detail for the purposes of this study (Tashakkori & Teddlie, 2003; Case, 2006; Bickman & Rog, 2009):

- Questionnaires;
- Interviews;
- Focus groups;
- Observation; and
- Secondary data, e.g. personal and official documents, physical data and archived research data.

4.3.1 Questionnaires

The *New Dictionary of Social Work* (1995:51) defines a questionnaire as “a set of questions on a form which is completed by the responded in respect of a research project.” A questionnaire is defined as a data-collection technique through which people are asked to respond to the same set of questions in a pre-determined order (Tashakkori & Teddlie, 2003). The basic objective of a questionnaire is to obtain facts and opinions about a phenomenon from people who are informed on the particular issue (De Vos *et al.*, 2002).

There are several types of questionnaires, differing according to the way they are delivered to the potential respondents. Questionnaires can be delivered to the respondents via mail, telephonically, by hand, group-administered or over the internet (Stanton & Rogelberg, 2001; Miller & Salkind, 2002). Self-administered questionnaires provide the least expensive way of eliciting attitudes, perceptions, beliefs, and reports of behaviour from many people (Bickman & Rog, 2009).

A mailed questionnaire is a questionnaire that is sent off by post or e-mail in the hope that the respondent will complete and return it. The researcher compiles the questionnaire and sends it with a clear, carefully worded request to participate and instructions on how to participate at the level of understanding of the targeted population. Although questionnaires typically use fixed-choice answers (i.e. closed questions), a few open-ended questions can be included to give respondents an opportunity to express themselves and share their opinion (Bickman & Rog, 2009).

Questionnaires can save a lot of time and effort, since a single set of questions is duplicated and sent to many respondents, allowing wide coverage of respondents (Robson, 1994; Tashakkori & Teddlie, 2003). This makes the use of questionnaires less costly and allows respondents to complete them at a time and place that suits them, thereby limiting any interference and bias that could be caused by the presence of the researcher (Bryman, 2001; Miller & Salkind, 2002; Bickman & Rog, 2009).

Bickman and Rog (2009:333) list the following advantages of using questionnaires:

- They are easy to quantify and summarise data collected.
- They offer the quickest and cheapest way to gather new data rigorously, neutrally and objectively.
- They are useful for large samples, repeat measures and comparisons among units.
- Standardised questionnaires contain pretested items, reflect diagnostic models and can be good for studying attitudes.

According to Robson (1994) and De Vos *et al.* (2002), and Bickman and Rog (2009), several disadvantages are associated with the collection of data using questionnaires. These include:

- Risks of high non-response rates, bias and invalid answers;
- Difficulty in probing responses since personal contact is lost;
- Difficulty in checking the honesty or seriousness of responses;
- No allowance for respondents to ask questions, should clarity be needed;
- Greater risk of missing useful or additional data; and
- Unsuitability for subtle or sensitive issues.

4.3.1.1 Survey research on the internet

Conducting questionnaire survey research on the internet has major benefits, as it offers wide access to a variety of people at low cost (Struwig & Stead, 2001; Bickman & Rog, 2009). However, as rightly argued by Struwig and Stead (2001), survey research on the internet is plagued by low or inadequate response rates and the question of response reliability in view of the increased bias of self-selection and self-report.

According to Struwig and Stead (2001), when implementing an internet instrument, special care must be taken in:

- Designing an instrument that is specifically constructed for online administration;
- Providing incentives for participation;
- Sending an introductory message separate from the instrument; and
- Constructing safeguards to preclude the alteration of the survey instrument.

Online forms such as Survey Monkey are now available on the internet, which makes it easier to implement surveys (Bickman & Rog, 2009).

4.3.1.2 Forms of online surveying

There are different methods for conducting online research. The most common forms of quantitative and qualitative online surveys are listed in Table 4.1 below (Bickman & Rog, 2009; Struwig & Stead, 2001).

Table 4.1 Types of online questionnaires that can be used in surveys[8]

Method	**Explanation**	**Advantages**	**Disadvantages**
E-mail	E-mails can be used to transmit questionnaires that can be automated using online tools	Easy, cheap and fast to conduct	Risk of low response Risk of being construed as spam and deleted
Bulletin boards	Inviting people to a specific website where a discussion topic is posted. As people post their responses to the question(s), participants can eventually see what others have posted in response to the question(s)	Posted messages are collected in one place Participants can easily read others' input	Takes longer to collect data
Web HTML	The use of flat Hyper-text Mark-up Language (HTML), usually for a single page where a respondent clicks buttons and boxes, fills in text boxes, and eventually submits the information for the questionnaire with one click of a button	Most common way of conducting online questionnaires, usually single page, which is quick and easy for the user	Cannot be used for complex logic or controls, e.g. retyping, and without instructions to do so
Web fixed-form interactive authoring tools	These involve software packages that allow sophisticated controls. Most of these packages exist as packaged software programmes, e.g. Survey Monkey (www.SurveyMonkey.com)	Powerful tools that make it easy for one to quickly develop a questionnaire using a variety of types of questions by means of the available functionality on the tool. Easy to analyse data and generate reports	The range of options in which the survey can be displayed is limited

[8] Types of online questionnaires that can be used in surveys (Adapted from Struwig & Stead, 2001:103-104)

Web-customised interactive programming	This is the most flexible of all online questionnaire options and involves the custom programming skills of highly technical people.	Unlike fixed-form tools, question/response styles, backgrounds, graphics, etc can meet the wishes of the researcher	Researcher needs to have the technical programming skills to develop and use the forms
Downloadable questionnaires	This type of questionnaire is downloadable from the web and runs on previously installed software provided by the researcher	Questions are already formulated and ready to use	Such surveys are costly and time consuming
Web-moderated interviewing: chat interviews and other discussion formats	Involves qualitative real-time chat interviews. Respondents type their answers to questions posed by a moderator. Also referred to as online focus groups	Information from respondents is collected and is instantly available to the researcher	Requires good and fast bandwidth for respondents

4.3.1.3 Collecting data from study sites

As noted by Outhwaite and Turner (2007) and Bickman and Rog (2009), the preparation of questionnaires is a complex and delicate operation and the nature, form and order of the questions are of great importance to the results of the inquiry. For this study, four questionnaires were developed and used to collect primary data from the four target groups. Letters were written to the heads of departments in the targeted disciplines seeking permission to distribute the questionnaires to the academic staff in their departments. Where permission was obtained, e-mails were sent to the academic staff. The questionnaires were administered to participants via printed copies administered by the researcher and enumerators at the universities.

Two enumerators were engaged to visit each of the five universities to distribute the questionnaires to academic staff and postgraduate students in the STM postgraduate programmes.

4.3.2 Interviews

Interviewing is the predominant mode of data or information collection in qualitative research (De Vos *et al.*, 2002; Bickman & Jog, 2009). Kvale (2001:1) defines qualitative interviews as “attempts to understand the world from the participants’ point of view, to unfold the meaning of people’s experiences and to uncover their loved world prior to scientific explanations.” King (1994:24) argue that the danger for researchers using interviews is that they may feel the method is familiar and straightforward and does not require much thought about what they are doing. At least as much thought must go into the design and execution of an interview study as into one using any other methodology.

Qualitative studies typically employ unstructured or semi-structured interviews. Unstructured interviews are sometimes referred to as in-depth interviews (King, 1994; De Vos *et al.*, 2002). Unstructured interviews are conducted without using any of a researcher's prior information, experience or opinions in a particular area. Semi-structured interviews are defined as those organised around areas of particular interest while still allowing considerable flexibility in scope and depth (King, 1994; Struwig & Stead, 2001; De Vos *et al.*, 2002; Bickman & Rog, 2009).

4.3.3 Focus groups as an interviewing method

Focus groups are group interviews. They are a means of gaining a better understanding of how people feel or think about an issue, product or service. Morgan (1997) describes focus groups as a research technique that collects data through group interaction on a topic determined by the researcher.

According to Morgan (1997) and De Vos *et al.* (2002), the advantages of using focus groups are the ability to:

- Produce concentrated amounts of data on precisely the topic of interest;
- Create a process of sharing and comparing among the participants;
- Provide a powerful means of exposing reality and investigating complex behaviour and motivation;
- Gain understanding of the diversity of people's experiences;
- Allow for a fuller, deeper understanding of the phenomenon being studied; and
- Stimulate spontaneous exchanges of ideas, thoughts and attitudes in the security of being in a crowd.

On the other hand, the disadvantages of focus groups are that they can (Morgan, 1997; Struwig & Stead, 2001; De Vos *et al.*, 2002):

- Be quite costly to conduct;
- Require researchers skilled in group processes;
- Be less likely for people to self-disclose or share personal experiences in groups;
- Bring bias into the study;
- Generate findings that cannot automatically be projected onto the population at large; studies based on focus groups often use a smaller number of participants; and

- Have the risk of passive participants unduly influenced or inhibited by active participants.

Interviews were not used in this study and therefore are not discussed in further detail.

4.3.4 Direct observation

When the observational method is used, data are collected by recognising and noting people’s behaviour, objects and occurrences (e.g. checking out books from a library) (Struwig & Stead, 2009). According to Denzin and Lincoln (2000), direct observation is the oldest and remains the commonest instrument of scientific research. Baker (2006) and Denzin (2012) affirm this view and further assert that the value of observation is that it permits researchers to study people in their native environment in order to understand “things” from their perspective. Observation requires the researcher to spend considerable time in the field with the possibility of adopting various roles in order to gain a more comprehensive understanding of the people being studied.

De Vos *et al.* (2002:274) refer to this approach as participant observation, since all forms of observation are basically similar and depend to a greater or lesser extent on participation, thus necessitating direct contact with the subjects of observation. They therefore describe participant observation “as a qualitative research procedure that studies the natural and everyday setup in a particular community or situation.”

The researcher should decide beforehand on the role he intends to take in the situation of a participant observer, since the roles to be taken can be placed on a continuum from complete observer to complete participant, with a variety of degrees of involvement in between. While doing the research, the researcher should take field notes, which should be written as well-formulated reports at the first available opportunity. These should be included in the final and formal report on the study.

Until recently, few library and information science studies have included this method; however, observation is gaining favour as library and information science researchers seek to understand the role of information in people's everyday lives better (Baker, 2006). Bickman and Rog (2009:333) cite the advantages of observation as method of data collection as follows:

- Data are independent of people’s self-presentation and biases.
- Data on situational, contextual effects can be included.

- Rich data on hard-to-measure topics, e.g. emergent behaviour and culture, can be collected.
- Data can yield new insights and hypotheses.

The disadvantages of observation as method for data collection are:

- There are constraints on access to data.
- It is costly and time-consuming.
- Observer bias and low reliability may occur.
- The behaviour of those observed may be affected.
- It is hard to analyse and report observations; it is less rigorous and may seem unscientific.

4.3.5 Secondary records

Secondary records refer to the study of documents and secondary analysis (Bickman & Rog, 2009; Denzin, 2012). The phrase is also sometimes understood as the study and analysis of life history, historical research and documents of life. Secondary records include documents such as letters to friends or family, diaries or autobiographies. They include the study of non-personal documents (De Vos *et al.*, 2002), such as the documents listed in Table 4.2 below.

Table 4.2 Types of secondary data records that can be used in data[9]

Type of information	**Description**	**Examples**
Personal documents	Documents with personal information	Letters to friends or family, diaries or autobiographies
Official documents	Non-personal documents	Minutes and agendas of meetings; inter-office memoranda; financial records; statistical reports; annual reports; process records; building contracts, etc
Mass media documents	Information freely available to the public	Newspapers; magazines; journals; television; radio; films and books (fiction and non-fiction), etc
Archival materials	Documents and data preserved in archives for research purposes	Computerised information that can be retrieved easily

According to Bickman and Rog (2009:333), the advantages of secondary data sources are:

- Using them is often cheaper and faster than gathering new data.
- They are independent sources.

[9] Types of secondary data records that can be used in data collection (Adapted from De Vos *et al.*, 2002:315-320)

- The organisation that provided the data's staff can often help analyse data.

Bickman and Rog (2009) list the disadvantages of using secondary sources:

- Problems with access, retrieval and analysis can raise costs.
- The validity and credibility of some sources can be low.
- Data need to be analysed in context.
- Limited information on many topics is available in secondary sources, e.g. emergent behaviour.

The analysis of secondary data as method of data collection will not be used in this study and it will therefore not be discussed any further.

4.3.6 Comparison of data-collection techniques

As discussed in the previous sections, a variety of techniques can be used to collect data. Table 4.2 summarises the advantages and disadvantages of using questionnaires, observation and interviewing techniques in general. The table highlights what has been discussed in the preceding sections.

Table 4.3 Comparison of data-collection techniques[10]

Method	Advantages	Disadvantages
Questionnaires Self-administered schedules, fixed choices	• Easy to quantify and summarise; quickest and cheapest way to gather new data rigorously, neutral and objective; less costly, as it can be sent to many respondents at the same time; allows respondents to complete them at a time and place that suits them; limits any interference and bias that could be caused by the presence of the researcher	• Low response rate; difficulty in probing responses since personal contact is lost; difficulty in checking honesty or seriousness of responses; no allowance for respondents to ask questions should clarity be needed; greater risk of missing data
Direct observation Open-ended questions based on fixed schedules or interview guide	• First-hand observations by gaining access to the target group; ability and opportunity to probe respondents further on aspects of the study	• Requires the researcher to spend considerable time in the field; concerns of ethical problems, as well as validity and reliability issues
Interviews Structured or open-ended observation of people, work settings	• Simple method to collect data; can cover many topics; modifiable before or during interview; can covey empathy; build trust	• Requires researchers to spend considerable time conducting the interviews
Secondary data Use of documents, reports, files, statistical records	• Often cheaper and faster than gathering new data; independent sources; nonreactive; often quantifiable repeated measures show change; organisation's members can help analyse data	• Access, retrieval, analysis problems can raise costs; validity, credibility of some sources can be low; need to analyse data in context; limited information available on many topics, e.g. emergent behaviour

[10] Table 4.3: Comparison of data collection techniques (adapted from Bickman & Rog, 2009:333)

According to Byström and Järvelin (1995:197), structured questionnaires and interviews have been reported to be the most frequent data-collection methods in information-seeking research. Hence, based on the reviewed literature, it was decided to use questionnaires in this study. The questionnaires were administered to four groups at the selected universities in Zimbabwe, namely:

- Information specialists (i.e. librarians in charge of library e-resources at the selected university libraries (Appendix I and III); and
- Academic staff at departments teaching in STM disciplines (Appendix II).

4.3.7 Intra-method and inter-method mixing

Between-strategies mixed methods data collection refers to research in which qualitative and quantitative data are gathered using multiple modes of collection, e.g. interviews, observation and focus groups. The use of different data-collection strategies has also been called inter-method mixing (Denzin, 1970; Tashakkori & Teddlie, 2003; Torrance, 2012) or data triangulation or methodological triangulation (Denzin, 1989; Bickman & Rog, 2009; Denzin, 2012; Howe, 2012).

Table 4.4 Intra-method and inter-method mixing[11]

Method	Explanation	Example
Intra-method, also referred to as method triangulation	Concurrent or sequential use of a single method that includes both qualitative and quantitative components	The concurrent use of open-ended and close-ended items on a single questionnaire
Inter-method mixing, also referred to as data triangulation	Concurrently or sequentially mixing two or more methods	Questionnaire and observation method

In this study questionnaires and observation are used to collect data. This multi-strategy is called "triangulation" (Bryman, 2001:509). The triangulation approach is defined as "the use of more than one method or source of data in a study of a social phenomenon so that findings may be cross-checked" (Bryman, 2001:509). Bickman and Rog (2009:245) point out that triangulation concerns collecting information from a diverse range of individuals

[11] Table 4.4: Intra-method and inter-method mixing. Source: Adapted from Tashakkori & Teddlie (2003:297)

and settings using a variety of methods. Clarke and Dawson (1999), Fox and Bayat (2007) and Denzin (2012) all concur with this. Triangulation tends to reflect and explain issues more accurately than any single measure. According to Mouton and Babbie (2001), Fox and Bayat (2007) and Howe (2012), triangulation is likely to increase reliability, since the complementary nature of multiple methods can counteract their respective shortcomings. As explained by Willis, Jost and Nilakanta (2007), Jost and Nilakanta (2007) and Bickman and Rog (2009), triangulation reduces the risk of chance associations and systematic biases because of a specific method and allows a better assessment of the generality of the explanations that one develops.

As indicated earlier, this study employed triangulation by:

- Using quantitative and qualitative questions in the questionnaires; and
- Employing questionnaires in the data collection.
- Imperical study findings were triangulated with findings of the literature review.

The following section explains the methods used by similar studies. Some employed triangulation combining data-collection techniques such as questionnaires, interviews, direct observation and focus group discussion in the studies, and collecting a combination of quantitative and qualitative data.

Data analyses are discussed in more detail in chapters 5 and 6.

4.3.8 Methods used in similar studies

The method or methods used in a research study determine what types of conclusions can be drawn about the sampled participants and what findings can be generalised to the population as a whole (Tenopir, 2003). Tenopir in her report for the Council on Library and Information Resources (CLIR) summarises and analyses more than 200 research publications that focus on the use of electronic library resources (published between 1995 and 2003). Eight major studies (each with multiple publications) were identified as Tier 1 studies and analysed in detail in the report, while about 100 smaller-scale studies were classified as Tier 2 studies and were examined together. The studies on which Tenopir (2003) reports used a variety of research methods, including observation, surveys, interviews, experiments and transaction log analysis. Some focused on preference, including how users feel about the library or about specific media; others asked questions that provided information on user behaviour. Observations, experiments and logs show what users do, but do not reveal reasons for preferences or motivations.

Table 4.5 gives the context of eight of the Tier 1 major studies investigated by Tenopir (2003), followed by details on the methods employed and the participants.

Table 4.5 Summary of the Tier 1 studies reviewed by Tenopir [12]

Study Name	Study Description	Method
SuperJournal (1995-1996)	The SuperJournal project is a group of studies of e-journal use that began in 1995 in the UK in response to the information explosion and limited budgets.	The researchers used a variety of research methods, including transaction log analysis, surveys, interviews and focus groups, to study how academic users interact with e-journals and what features they value. Academic scientists and social scientists were studied, including both faculty and students in selected British universities.
Digital Library Federation/Council on Library and Information Resources/Outsell (DLF/CLIR/Outsell) (2001-2002)	Outsell, Inc. conducted a survey of information use for the DLF and CLIR in 2001 and 2002.	Telephonic interviews were conducted with 3 234 faculty members, graduate and undergraduate students across seven subject disciplines at private and public doctoral research universities and leading liberal arts colleges. They were asked about their use and preferences for both print and electronic resources from the library.
HighWire/ E-Journal Users Study (eJUSt) (2000-2002)	The Stanford e-JUSt was published by HighWire Press. The participants included graduate students, faculty members and clinicians from universities, hospitals and government and academic research institutes from 99 countries. The studies were conducted between November 2000 and August 2002.	The study used a variety of methods to gain insights into the use of e-journals, including qualitative user surveys, transaction log analysis and an ethnographic study of scholarly e-journal usage. The qualitative user surveys were done online with participants taken from subscribers to HighWire's medical and scientific journal Table of Contents service.
Pew Internet and American Life (also OCLC/Harris, and Urban Libraries Council) (2000)	The Pew Internet and American Life Project conducted two studies about how students use the internet. In the "Internet Goes to College" project 2 054 college students at two- and four-year public and private colleges completed surveys. In addition, graduate student researchers observed the behaviour of college students at colleges and universities in the Chicago area. In the other Pew Internet and American Life Project, "The Digital Disconnect: The Widening Gap between Internet Savvy Students and their Schools", middle and high school students were studied between November 2001 and March 2002. About 200 students wrote essays in which they expressed how they and their friends used the internet for school and how they might use it in the future. Both these studies included how the students viewed the library. OCLC/Harris and the Urban Libraries Council conducted similar surveys comparing library and internet use by students and the public respectively.	In the OCLC/Harris study, 1 050 participants were surveyed between 11 December 2001, and 1 January 2002. In the Urban Libraries Council study, 3 097 participants were surveyed by telephone between March and April 2000.

[12] Summary of the Tier 1 studies reviewed by Tenopir (2003:56)

OhioLINK (1998)	The Ohio Library and Information Network is a consortium of Ohio's college and university libraries and the State Library of Ohio. The consortium serves more than 500 000 students, faculty members and staff at more than 80 institutions of higher learning. OhioLINK's Electronic Journal Center makes electronic articles and journals available to OhioLINK members. This study began in April 1998.	Transaction log analysis is used to measure the number of articles users' download from the Electronic Journal Center.
Tenopir and King Studies (2002)	The Tenopir and King research studies are a series of surveys of more than 16 000 scientists, engineers, medical professionals and social scientists in university and non-university research settings. These experiments began in 1977 and focused on how reading patterns have changed over time with the adoption of e-journals and what role library-provided journals play in overall reading patterns.	The surveys measured reading and authorship patterns of these subject experts through critical incident, demographic and usage questions. Information-seeking behaviours, amount of reading, purposes of reading, and source of readings were all measured.
LibQUAL+™ (2002)	LibQUAL+™ studies were conducted by the ARL in conjunction with Texas A&M University. The students answered questions about their library's level of service that they found minimally acceptable, the level they perceived, and the level they desired. The results were presented by status of respondent and type of institution. Only those few questions that focused on desired levels for print and electronic collections and services were relevant and were reported by Tenopir (2003).	The study surveyed students, faculty members and staff at various community colleges, four-year colleges and health science schools in the USA as well as the New York Public Library and Smithsonian Institution during the spring of 2002. More than 70 000 faculty members, staff and students reported on how often they used the physical and electronic libraries.
JSTOR (2002)	The JSTOR system provides electronic archives of back issues of scholarly journals. In 2000 JSTOR carried out a study on the use of its system. In addition, some JSTOR subscribing libraries analysed their use of the JSTOR journals in their specific library environment.	The study surveyed more than 4 000 academic users of the collection in the humanities, social sciences and economics to discover usage patterns and preferences of university faculty members. JSTOR also used log analysis of both viewed and printed articles to characterise use of its materials.

Each of the eight Tier 1 studies examined a variety of participants, with college and university students and faculty members studied most often, followed by practitioners and other subject experts in science, engineering, health and social sciences (Tenopir, 2003). Table 4.6 summarises the main participants included in each study.

Wang (1999) provides an overview of methods for user behavioural research. An extension of her categorisation of methods is used here to highlight the Tier 1 studies reviewed by Tenopir (2003). Tier 1 studies use one or more of the following methods:

- Surveying users
- Interviewing users (including focus groups)

- Observing users through experiments
- Observing users in natural settings (including keeping journals)
- Transaction log analysis (included under "observing users" in Wang 1999).

Covey (2002) also categorises usage studies to help librarians design the most appropriate studies for the type of information they hope to gather. Covey's categories of research studies are similar to Wang's and include:

- Surveys (questionnaires)
- Focus groups
- User protocols (experiments and observations are both included here)
- Other (heuristic evaluations, paper prototypes and scenarios, and card-sorting tests)
- Transaction log analysis.

Table 4.6 summarises the methods used by the Tier 1 studies (Tenopir, 2003). Several use multiple methods for different phases of their projects; others rely on a single method.

Table 4.6 Methods used in the Tier 1 studies as reported by Tenopir (2003)[13]

Study	Participants	Methods
SuperJournal	Students and faculty members	Logs, surveys, focus groups or interviews
DLF/CLIR/Outsell	Students and faculty members	Interviews
HighWire/eJUSt	Scholars and clinicians	Surveys, interviews or logs
Pew/OCLC-Harris/Urban Libraries council	Middle, high school and college students/general public	Surveys, observation, focus groups or journal keeping
OhioLINK	OhioLINK users	Logs
Tenopir and King	Scientists and social scientists (academic and non-academic)	Surveys or critical incident
LibQUAL+™	Library users at institutions of higher education	Surveys
JSTOR	Education (students and faculty)	Logs

User studies are essential, as they are practical ways to assess, design and improve the digital libraries for maximum user-friendliness (Dobreva, O'Dwyer & Konstantelos, 2011). In more recent studies reported by Dobreva, O'Dwyer and Feliciati (2012) a trend towards similar methods of data collection was reported, for instance the "Digitisation of Special

[13] Methods used in the Tier 1 studies as reported by Tenopir (2003)

Collections: Mapping, assessment and prioritisation” (DiSCmap) project study undertaken between September 2008 and March 2009 in UK higher education institutions. The aims and objectives of the study were to identify priority collections to be digitised in selected disciplines, to assess user’s needs and demands for special collections and to produce a synthesis of previous and current studies that focused on identifying researchers’ needs with regard to issues of usability ad consumption of digital resources. Table 4.7 below outlines the methods employed in the study.

Table 4.7 Methods used in the DiSCmap project

Name	Study description	Method
DiSCmap project	The DiSCmap project took a collaborative approach to the creation of a user-driven digitisation, prioritisation framework, encouraging participation and collective engagement between LIS professionals and patrons. This was achieved through focus groups, interviews and two online questionnaires.	The project team asked 1 200 intermediaries and end-users a variety of questions about which physical and digital collections they made use of and what criteria they felt had to be considered when selecting materials for digitisation. A combination of several methods was used for user studies: • Web-based questionnaire that gathered responses from intermediaries • End-user survey (by using a combination of web-based questionnaires, focus groups and telephone interviews).

In the DiSCmap project, distribution of the questionnaire to UK universities was achieved by using a database of contacts compiled for the intermediaries’ survey, which contained an identified intermediary from each higher education library, to whom a request was e-mailed to distribute an invitation to staff of the institution to participate in the online survey.

4.3.9 Reliability and validity in research and research methods

The research methods and the measuring instruments to collect data must deliver both reliable and valid data if the researchers’ interpretation of the data collected is to be valuable (Gay, Mills & Airasian, 2011).

4.3.9.1 Validity

The definition of validity concerns two issues: the instrument measures the concept in question and the concept is measured accurately (De Vos *et al.*, 2002:160). The definition of measurement widely accepted states that “measurement is the assignment of numbers or events according to rules” (Carmines & Zeller 1979:101). Validity refers broadly to the degree to which an instrument is doing what it is intended to do. An instrument may have several purposes that vary in number, kind and scope (De Vos *et al.*, 2002:160). The common categories of validities are:

- Content or face validity;
- Criterion validity; and
- Construct validity.

According to De Vos *et al.* (2002), Gravetter and Forzano (2003), and Bickman and Rog (2009), content or face validity (the terms are often used interchangeably) concerns whether the measurement technique is measuring the variable that it claims to measure. Criterion or criterion-related validity moves away from subjective assessments of face validity and provides more objective evidence of validity. This involves multiple measurement and is established by comparing scores on an instrument with an external criterion known to, or believed to, measure the concept, trait or behaviour being studied (De Vos *et al.*, 2002). Bostwick and Kyte (1981), De Vos *et al.* (2002) and Bickman and Rog (2009) argue that of the three common approaches to validation, construct validity is the most difficult because it involves determining the degree to which an instrument successfully measures a theoretical construct such as intelligence, conformity, cohesion, social class or prejudice.

4.3.9.2 Reliability

According to Bostwick and Kyte (1981:113), reliability has been defined as the accuracy or precision of an instrument, as the degree of consistency or agreement between two independently derived sets of scores and as the extent to which independent administration of the same instrument yields the same or similar results under comparable conditions.

De Vos *et al.* (2002) agree with this definition and add that reliability refers in general to the extent to which independent administration of the same instrument (or highly similar instruments) consistently yields the same (or similar) results under comparable conditions.

Neuman and Kreuger (2003) and Bickman and Rog (2009:403) argue that it is rare to have perfect reliability, but they suggest the following procedures to increase the reliability of measures:

- Clear conceptualisation of all constructs i.e. developing an unambiguous clear theoretical definition for each construct used and then making sure that each measure indicates only one specific concept;

- Increasing the level of measurement by trying to measure at the most precise level possible;
- Using multiple indicators of a variable, i.e. using two or more indicators, such as two or more questions in a questionnaire to measure each aspect of a variable; and
- Using pre-tests, pilot studies and replications, e.g. developing drafts or preliminary versions of a measure and testing these before applying the final version in a hypothesis-testing situation.

A questionnaire was used in this study and its reliability and consistency were tested during a pilot study. Section 4.5.3 discusses the questionnaire and its uses in this study.

The following section discusses the sampling procedures and the rationale of the procedures employed in the study.

4.4 POPULATION SAMPLE AND SAMPLING PROCEDURES

In any study, the sample chosen is critical to the research process (Landreneau & Creek, 2009). The sampling strategy chosen from the onset should ensure that the sample used in the research adequately represents the population from which it is drawn (Robson, 1994; De Vos *et al.*, 2002; Landreneau & Creek, 2009; Monette, Sullivan & DeJong, 2013). De Vos *et al.* (2002) assert that one studies a sample in an effort to understand the population from which it was drawn. As such, one is interested in describing the sample not primarily as an end in itself, but as a means of helping one to explain some facet of the population (Monette, Sullivan & DeJong, 2013).

4.4.1 Population sample

Arkava and Lane (1983:27) succinctly define a sample as “comprising elements of the population considered for actual inclusion in the study, or it can be viewed as a subset of measurements drawn from a population in which we are interested.” A sample is thus a selection from the population, where “population” refers to all subjects being considered. Sampling therefore means taking any portion of a population or universe as representative of that population or universe (Kerlinger, 1986). It is important to note that this definition does not say that the sample taken (or drawn) is in fact representative. Rather the sample is considered to be representative (De Vos *et al.*, 2002). A representative sample should be an unbiased indication of what the population is like, i.e. a subset of a statistical population that accurately reflects the members of the entire population.

One can only generalise the findings of a study when it is considered representative of the population and when one can assume that what one observed in the sample of subjects would also be observed in any other group of subjects from the particular population. The term sample "always implies the simultaneous existence of a population or universe of which the sample is a smaller section or a set of individuals selected from a population" (Gravetter & Forzno, 2003: 465).

The main reason for sampling is feasibility when working with a large population (Sarantakos, 2000; Yates, 2004). Sampling makes the study manageable. As rightly argued by several authors (De Vos *et al.*, 2002; Struwig & Stead, 2001; Wisker, 2001), even if it were theoretically possible to identify, contact and study the entire relevant population in case of a large population, time and cost considerations usually make this a prohibitive undertaking. Therefore determining the right size of the sample from a population is important.

4.4.2 Size of the sample

According to Neuman and Kreuger (2003), it is generally stated that the larger the population, the smaller the percentage of that population the sample needs to be, and vice versa. If the population itself is relatively small the sample should comprise a reasonably large percentage of the population (De Vos *et al.*, 2002). This implies that at times sampling is not used when the population is small and it is feasible and affordable to cover subjects in the population.

The size of the sample is also influenced by the relative homogeneity or heterogeneity of the population, and the desired degree of reliability for the purposes of the investigation (Miles & Huberman, 1994; Singleton *et al.*, 1997; Struwig & Stead, 2001). This means the level of similarity of the subjects in the population under consideration and required level of accuracy help determine the sample size drawn.

De Vos *et al.* (2002) argue that differences of opinion exist with regard to the minimum number of respondents that should be involved in an investigation. Grinnell and Williams (1990) contend that 30 is sufficient to perform basic statistical procedures, while others feel that a minimum of 100 is sufficient. For qualitative (non-statistical research) samples are often smaller. It is not always possible to draw a sample in a qualitative investigation, because the total population can be quite small, and it is preferable for the total population to be involved in such cases (De Vos *et al.*, 2002).

4.4.3 Sampling procedures, convenience, purposive, census sampling

There are two different types of sampling procedures: probability and non-probability (Robson, 1994; Struwig & Stead, 2001; Monette, Sullivan & DeJong, 2013). Probability sampling methods ensure that there is a possibility for each person in a sample population to be selected, whereas non-probability methods target specific subjects.

In probability sampling it is possible to specify the probability that any person will be included in the sample categories (Struwig & Stead, 2001; De Vos *et al.*, 2002). Hence a probability sampling method is any method of sampling that uses some form of random selection. There are various strategies for probability sampling, including simple random sampling, such as systematic sampling, stratified random sampling, cluster sampling and panel sampling (Robson, 1994; Landreneau & Creek, 2009). Non-probability sampling does not involve random selection, but probability sampling does. Non-probability sampling includes accidental sampling, purposive sampling, quota sampling, dimensional sampling, target sampling and snowball sampling. These are briefly discussed under the two main headings of probability sampling techniques and non-probability sampling techniques

4.4.3.1 Probability sampling techniques

To contextualise the choice of sampling techniques for this study, the techniques for probability sampling are briefly sketched. For simple random sampling each individual subject in the population theoretically has an equal and independent chance to be selected for the sample (Robson, 1994; De Vos *et al.*, 2002). Variations in this method include stratified random sampling, cluster sampling, systematic sampling and multi-stage area sampling (Struwig & Stead, 2001).

With systematic sampling only the first subject is selected randomly, preferably from a random table (De Vos *et al.*, 2002). It includes a procedure in which an initial point is selected by a random process and then every *n*th number on the list is selected (Struwig & Stead, 2001).

Cluster sampling is usually used when a sampling frame such as a list of names is not available, but only a map of the relevant geographical area for the population (De Vos *et al.*, 2002).

Stratified random sampling is mainly used to ensure that different groups or segments of a population acquire sufficient representation in a sample (Robson, 1994; Wisker, 2001; Monette, Sullivan & DeJong, 2013). It is a method of sampling that involves the division of a population into smaller groups known as strata. The strata are formed based on members' shared attributes or characteristics. A random sample from each stratum is taken in a number proportional to the stratum's size when compared to the population. These subsets of the strata are then pooled to form a random sample (Monette, Sullivan & DeJong, 2013).

It differs from random sampling in that in random sampling the sample items or respondents are chosen from the entire universe (Struwig & Stead, 2001).

With panel sampling a fixed panel of persons is selected from the population of persons involved in a particular issue (De Vos *et al.*, 2002).

4.4.3.2 Non-probability sampling techniques

As mentioned in 4.4.3.1, the probability of any member of the population being chosen is unknown when using non-probability sampling (Struwig & Stead, 2001; Wisker, 2001). The selection of sample subjects is arbitrary, as researchers rely heavily on personal judgements (Struwig & Stead, 2001). The most frequently used types of non-probability sampling include accidental sampling, purposive sampling, quota sampling, dimensional sampling, target sampling and snowball sampling *(*De Vos *et al.*, 2002; Struwig & Stead, 2001; Monette, Sullivan & DeJong, 2013).

For accidental sampling, also referred to as convenience sampling, participants are chosen purely on the basis of availability (Struwig & Stead, 2001). As explained by De Vos *et al.* (2002), any subject that happens to cross the researcher's path and has anything to do with the phenomenon can be included in the sample until the desired number is obtained.

Purposive sampling, also referred to as judgement sampling, is based on the judgment of the researcher, in that a sample is composed of elements that contain most characteristics, representative or typical attributes of the population (Singleton *et al.*, 1997; Struwig & Stead, 2001; De Vos *et al.*, 2002; Monette, Sullivan & DeJong, 2013). Miles and Huberman (1994) add that purposive sampling permits the selection of subjects whose qualities or experiences enable understanding of the phenomena in question, and are therefore valuable; this is the strength of purposive sampling. They argue that it is also appropriate for qualitative research with small samples.

With quota sampling, population subjects may be selected according to their characteristics, e.g. age, income, socio-economic status and gender (Struwig & Stead, 2001).

Dimensional sampling is when all variables in the population that are of interest to the investigation are specified and then it is ensured that each dimension is represented by at least one subject. The method entails that only a few cases representing the dimensions are studied in depth (De Vos *et al.*, 2002).

Target sampling is defined by Biernacki and Waldorf (1989:420) as "a purposeful, systematic method by which controlled lists of specified populations within geographical districts are developed and detailed plans are designed to recruit adequate numbers of cases within each of the targets."

Snowball sampling refers to a variety of procedures in which initial respondents are selected by probability methods but in which additional respondents are then obtained from information provided by the initial respondents (Struwig & Stead, 2001).

As argued by Miles and Huberman (1994) and Jackson and Mazzei (2008), in most cases it is not feasible or necessary to survey the entire population relevant to the study. However it is important that a researcher selects a sample that is representative or a subset of the entire population. Hence to draw meaningful, reliable and valid conclusions, the sample should closely reflect the study population, i.e. it should be a representative sample.

4.5 APPLICATION OF TECHNIQUES TO RESEARCH PROBLEM AND SITUATION

In any research investigation, the method of sampling used plays a major role in the study, as often it is the characteristics, composition and scale of the sample that gives weight to any findings that emerge from the study (Biernacki & Waldorf, 1981; Miles & Huberman, 1994).

4.5.1 Choice of sampling method

In the study, purposive sampling was used to select participating universities and faculties. As earlier stated, in 2014 there were fourteen public and private universities – i.e. nine public and five private universities. Of the approximately 40 000 students enrolled at universities in Zimbabwe about 23% were at the private universities (SARUA, 2013).

When purposive sampling was applied to all fourteen universities, five institutions (i.e. Africa University (AU), Chinhoyi University of Technology (CUT), Midlands State University (MSU), National University of Science & Technology (NUST), and University of Zimbabwe (UZ)) were selected that offered postgraduate studies in STM disciplines. This means the departments in these universities have a research focus. From each study site, data were collected from academic staff teaching in STM disciplines and information specialists responsible for e-resources in the libraries at the five universities. See Table 4.8 below.

Table 4.8 STM faculties or schools at universities in Zimbabwe

	Name of University	STM Faculties	STM postgraduate programmes
1	Africa University	Faculty of Agriculture	Yes
2	Bindura University of Science Education (BUSE)	School of Science and Technology	None
3	Catholic University	None	None
4	Chinhoyi University of Technology (CUT)	School of Agricultural Sciences and Technology	Yes
5	Great Zimbabwe University (GZU)	None	None
6	Harare Institute of Technology (HIT)	Faculty of Science and Technology	None
7	Lupane State University	Faculty of Agriculture	None
8	Midlands State University (MSU)	Faculty of Natural Resources Management and Agriculture Faculty of Science and Technology	Yes
9	National University of Science & Technology (NUST)	Faculty of Applied Sciences Faculty of Medicine Faculty of Industrial Technology	Yes
10	Solusi University	None	None
11	University of Zimbabwe (UZ)	School of Medicine Faculty of Agriculture Faculty of Science Faculty of Veterinary Sciences	Yes
12	Women's University in Africa (WUA)	Faculty of Agriculture	Yes
13	Zimbabwe Open University (ZOU)	None	None
14	Zimbabwe Ezekiel Guti University	Faculty of Agriculture	None

Data available indicate that in 2012, 34% of students enrolled at public universities were in the scientific, technological and medical (STM) disciplines (SARUA, 2014). The majority of enrolments that year were in business, management and law, followed by the humanities (Table 4.9).

Table 4.9 Student enrolments by major field of study and level of study[14]

Major field of study	Undergraduate	Master's	Doctoral	Other e.g. short courses
Agriculture	1 450	29	5	-
Business, management and law	12 585	2 461	47	-
Education	4 350	46	250	-
Health sciences	1 975	35	15	-
Humanities and social science	10 319	617	25	92
Science, engineering and technology	4 832	759	30	-
Other	581	-	25	28

The researcher chose to focus on the access and use of library electronic information resources by two groups at the selected universities:

- Academic staff (i.e. lecturers and professors) teaching in science, technological and medical (STM) disciplines (i.e. agriculture, health/medicine, environment and related sciences) at the universities.
- Information specialists (i.e. librarians in charge of library electronic information resources at the university libraries).

Academic staff, besides teaching, undertake research as part of their duties and they access and use library electronic information resources, as the literature review points to. Some are also teaching and/or supervising research on postgraduate level. Information specialists, usually based in the library, assist academic staff and students to access relevant information using available library electronic information resources at the universities. Stratified sampling was used to select participants.

[14] Sources: SARUA (2014), Agricultural Education Training in Africa Portal (2014)

Table 4.10 Selected universities' student populations, academic staff and information specialists[15]

University	Student Population*	Faculties and Schools of Sciences, Technology and Medical (STM)*		
		Academic Staff (STM)	Postgraduate Students (STM)	Information Specialists
University of Zimbabwe (UZ)	12 466	70	435	55
National University of Science and Technology (NUST)	4 781	45	167	20
Chinhoyi University of Technology (CUT)	1 885	8	26	15
Africa University (AU)	1 200	15	60	30
Midlands State University (MSU)	10 387	14	46	25
		152	**734**	**145**

According to SARUA (2013), World of Learning (2013) and AET-Africa portal (2014), the student population at the five universities totalled about 28 000 in 2013. STM schools or faculties had 665 master's students, 69 doctoral students, 152 academic staff teaching in the postgraduate degree programmes, and 145 information specialists in the libraries.

4.5.1.1 Academic staff

Academic staff (i.e. lecturers, senior lecturers, associate professors and full professors) teaching in the STM disciplines were targeted at each of the five universities. The academic staff must be involved in teaching an STM subject to be selected for the survey. University yearbooks and prospectuses were consulted to identify the numbers of academic staff at the universities.

4.5.1.2 Information specialists

Information specialists based in the libraries of selected universities responsible for library electronic information resources access, use and support were targeted for the survey at the five universities. About 150 information specialists have been identified at the five

[15] Sources: SARUA, 2014 (www.sarua.org), World of Learning, 2013 (www.worldoflearing.org), Agricultural Education Training in Africa Portal, 2014 (www.aet-africa.org)

universities. Only information specialists responsible for library electronic information resource collections access were included in the survey. Library staff lists were consulted to select these information specialists at each of the five universities. On average there were five to six information specialists responsible for library electronic information resources at each university (Chikonzo, 2014; Malapela, 2014) and therefore about 30 information specialists were targeted to participate in the survey.

4.5.2 Study sites

As indicated in Chapter 1, in 2014, fourteen public and private universities operated in Zimbabwe (see Table 4.8 above). Seven ran postgraduate degree programmes; five, were public and two were privately owned. Of these, five had postgraduate degree programmes in the science, technological and medical (STM) fields.

The study were conducted at the five universities with STM faculties, namely Africa University (AU), Chinhoyi University of Technology (CUT), Midlands State University (MSU), National University of Science and Technology (NUST) and University of Zimbabwe (UZ). Following is a brief description of each of the selected sites.

4.5.2.1 University of Zimbabwe (UZ)

Established in 1952, the University of Zimbabwe (http://www2.uz.ac.zw) is the largest and oldest university in Zimbabwe. The university has ten faculties: Arts, Education, Law, Commerce, Agriculture, Science, Veterinary Science, Medicine, Engineering, and Social Studies, and a number of institutes namely: Institute of Environmental Science, Confucius Institute, Institute of Developmental Studies, Institute of Mining Research, and Centre for Defence Studies. The faculties running master's and doctoral degrees in STM fields selected for the study are the Faculties of Agriculture, Science, Veterinary Science, and Medicine and the Institute of Environmental Science.

4.5.2.2 National University of Science and Technology (NUST)

The National University of Science and Technology (NUST) (www.nust.ac.zw) is a public university located in Zimbabwe's second largest city of Bulawayo and was established in 1991. It runs six faculties: Communication and Information Science, Built Engineering, Commerce, Applied Science, Industrial Technology, and Medicine.

The university runs postgraduate degree programmes at the School of Forest and Wildlife Management and the School of Environmental Health which were both inaugurated at the start of the university. The two schools were included in the study as they were the only schools with STM degree programmes at master's and doctoral levels at this institution.

4.5.2.3 Africa University (AU)

Africa University (AU) (http://www.africau.edu/), a United Methodist-related institution, was established on January 21, 1992 and became the first private university in Zimbabwe.

Africa University has six faculties (the Faculty of Agriculture and Natural Resources, the Faculty of Education, the Faculty of Health Sciences, the Faculty of Humanities and Social Sciences, the Faculty of Management and Administration, and the Faculty of Theology) and the Institute of Peace, Leadership and Governance. The two offering STM disciplines with postgraduate students are the faculties of Agriculture and Natural Resources and Health Sciences which will be targeted in the study.

4.5.2.4 Chinhoyi University of Technology (CUT)

The Chinhoyi University of Technology (CUT) (http://www.cut.ac.zw/) was established by an Act by the Parliament of Zimbabwe on 10 December 2001. Academic programmes are delivered through eight faculties: School of Agricultural Sciences and Technology, School of Engineering Sciences and Technology, School of Entrepreneurship and Business Sciences, School of Hospitality and Tourism, School of Art and Design, School of Natural Sciences and Mathematics, School of Wildlife, Ecology and Conservation and the Institute of Lifelong Learning and Development Studies.

Postgraduate students were reported to be registered in two STM programmes in 2009 (i.e. Schools of Agricultural Sciences and Technology and School of Engineering Sciences and Technology). These two are included in the survey.

4.5.2.5 Midlands State University (MSU)

The Midlands State University (MSU) (http://www.msu.ac.zw/) was established in 2002 and is located in the city of Gweru. Midlands State University offers degree programmes in seven faculties, i.e. Arts, Commerce, Education, Law, Natural Resources Management and Agriculture, Science and Technology, and Social Sciences.

Postgraduate degree programmes are offered in the Natural Resources Management and Agriculture, Science and Technology and Social Sciences disciplines. Therefore only the

Natural Resources Management and Agriculture, Science and Technology which offers STM degree programmes at Masters and Doctoral levels were included in the survey.

4.5.3 Pilot study

A pilot study refers to taking the draft research plan and applying it in a neutral location that will not be used in the actual fieldwork, or collection of preliminary data in the actual location (s) from which data are to be collected (Gorman & Clayton, 2005).

Struwig and Stead (2001) and Gorman and Clayton (2005) argue that a pilot study could also be used to test the following:

- Survey language
- Content of questions
- Length and approach of the interviews and focus group discussions
- Observation techniques

Revisions of the instruments are then made accordingly from the pilot study so that the actual study when undertaken is of better quality.

In this study the developed questionnaires were tested at the University of Zimbabwe in order to improve the above characteristics of the questionnaires before the actual field implementation.

Two questions that were reported not clear in Qustionnaires 3 and 4 were dropped and Questionnaires 1 and 2 did not pose any problems. Secction 4.5.3.2 discusses the questionnaire sections in detail.

4.5.4 Questionnaire design

Generally questions for a questionnaire are designed by interviewing people to determine the content area and/or by consulting the literature (Struwig & Stead, 2001). Once a draft is written it is important to conduct a pre-test (pilot) study (as explained in the previous section) and to select a small sample of respondents to complete the draft questionnaire. The sample should indicate any problems respondents may have with the instructions or the items (e.g. difficulty in understanding the meaning of the words or items) (Bickman & Rog, 2009; Struwig & Stead, 2001; De Vos *et al*., 2002).

4.5.3.1 General guidelines to questionnaire design

Since response to a questionnaire is voluntary it is important to design the instrument to maintain interest of the respondent. In this regard, Struwig and Stead (2001:89-90) argue that the questionnaire should:

- Contain precise and clear instructions on how to answer questions;
- Be divided into logical sections by subject;
- Start with questions that are easy to answer;
- Proceed from general to specific questions;
- Ask personal or sensitive questions last;
- Avoid subject-related or technical jargon;
- Employ the respondent's vocabulary; and
- Minimise the number of questions to avoid respondent fatigue.

Each question posed in the questionnaire were linked to the research sub-question to ensure that it is relevant and added some value to the study.

For purposes of the study there were four questionnaires:

- Questionnaire 1: Questionnaire for each participating library
- Questionnaire 2: Questionnaire for information specialists charged with e-resources
- Questionnaire 3: Questionnaire for academic staff teaching in STM disciplines
- Questionnaire 4: Questionnaire for postgraduate students in STM disciplines

4.5.3.2 Questionnaire Sections

This section explains each section for the four questionnaires that were used and the five selected universities.

Questionnaire 1: Questionnaire for library directors or their representatives. This questionnaire was administered to library directors, heads of libraries or their representatives

The questionnaire consists of 25 questions distributed over five sections as follows:

Section A: Personal profile
Section B: Library collection
Section C: Internet access in the library
Section D: Actual use of the e-resources
Section E: E-resources training

Questionnaire 2: Questionnaire for information specialists responsible for e-resources

This questionnaire was administered to information specialists responsible for library e-information resource access and use at the libraries in the five universities. The questionnaire consists of 26 questions distributed over six sections as follows:

Section A: Personal profile

Section B: Internet use and access

Section C: Information resources

Section D: Access and use of e-resources

Section E: Factors that influence use and non-use

Section F: E-resources training

Questionnaire 3: Questionnaire for academic staff teaching in STM disciplines.

This questionnaire was administered to academic staff, i.e. lecturers, senior lecturers, associate professors and full professors teaching at the STM faculties offering postgraduate degree programmes at the five universities. The questionnaire consists of 25 questions distributed over five sections as follows:

Section A: Personal profile

Section B: Internet access and use

Section C: Access and use of e-resources

Section D: Factors influencing the use and non-use of e-resources

Section E: E-resources training

Questionnaire 4: Questionnaire for postgraduate students in STM disciplines.

This questionnaire was administered to postgraduate students in STM faculties offering degree programmes at the five universities. The questionnaire consists of 22 questions distributed over five sections as follows:

Section A: Personal profile

Section B: Internet access and use

Section C: Access and use of e-resources

Section D: Factors influencing the use and non-use of e-resources

Section E: E-resources training

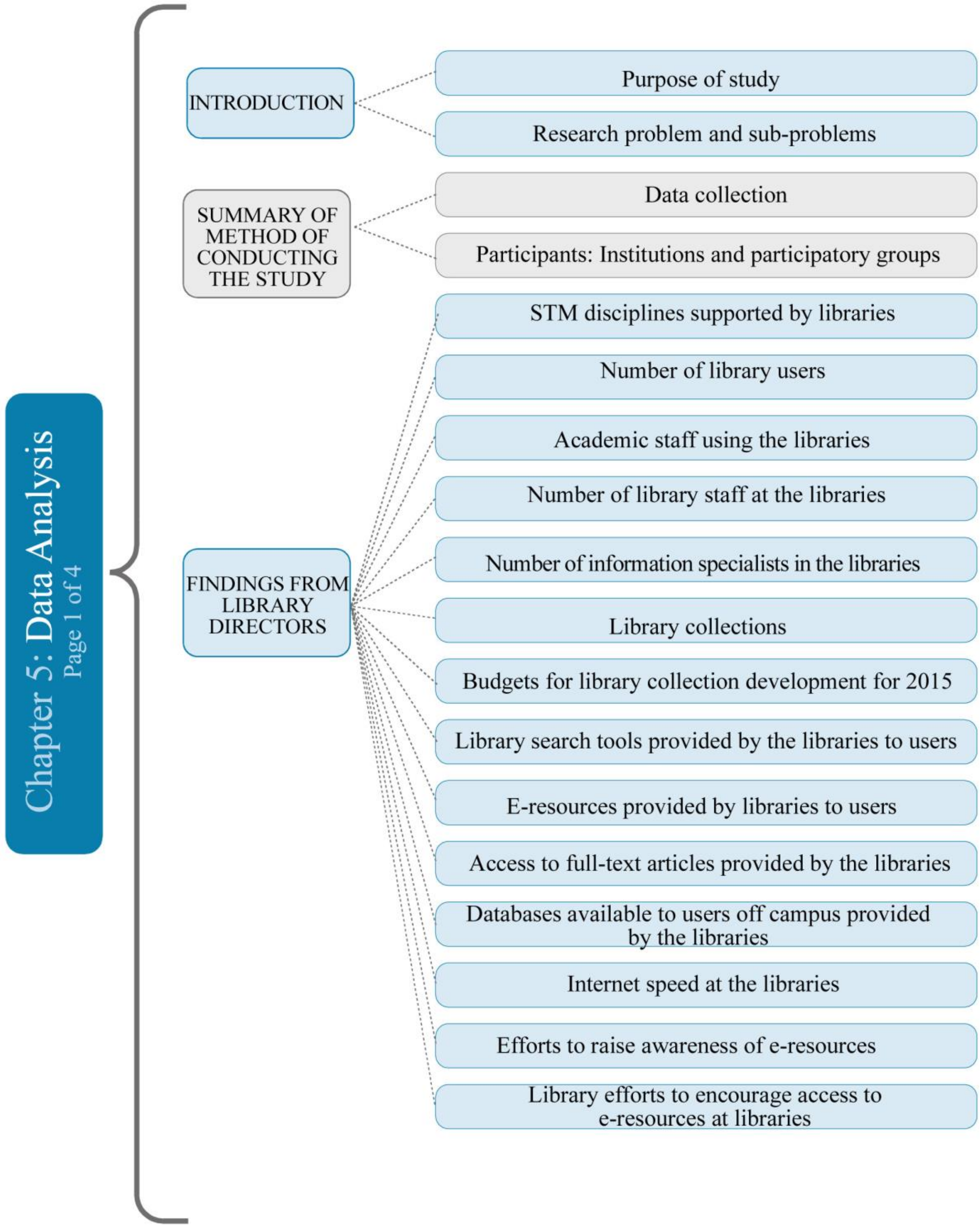
Appendices 1, 2, 3 and 4 present the questionnaires developed for each targeted group.

Chapter 5 covers the findings of the empirical component of the study. Descriptive statistical findings, and findings from the limited qualitative data, are presented for the various groups from whom data were collected.

4.6 SUMMARY

The collection of data to answer the principal and subsidiary research questions of the study was discussed. The chapter explained the research design, methods of research, techniques of research, population sample and sampling techniques and the data collection methods employed. It also discussed data analysis and articulates the issues of data quality, reliability, triangulation and validity. Probability and non probability sampling methods were discussed.

CHAPTER FIVE: DATA ANALYSES
Chapter Overview



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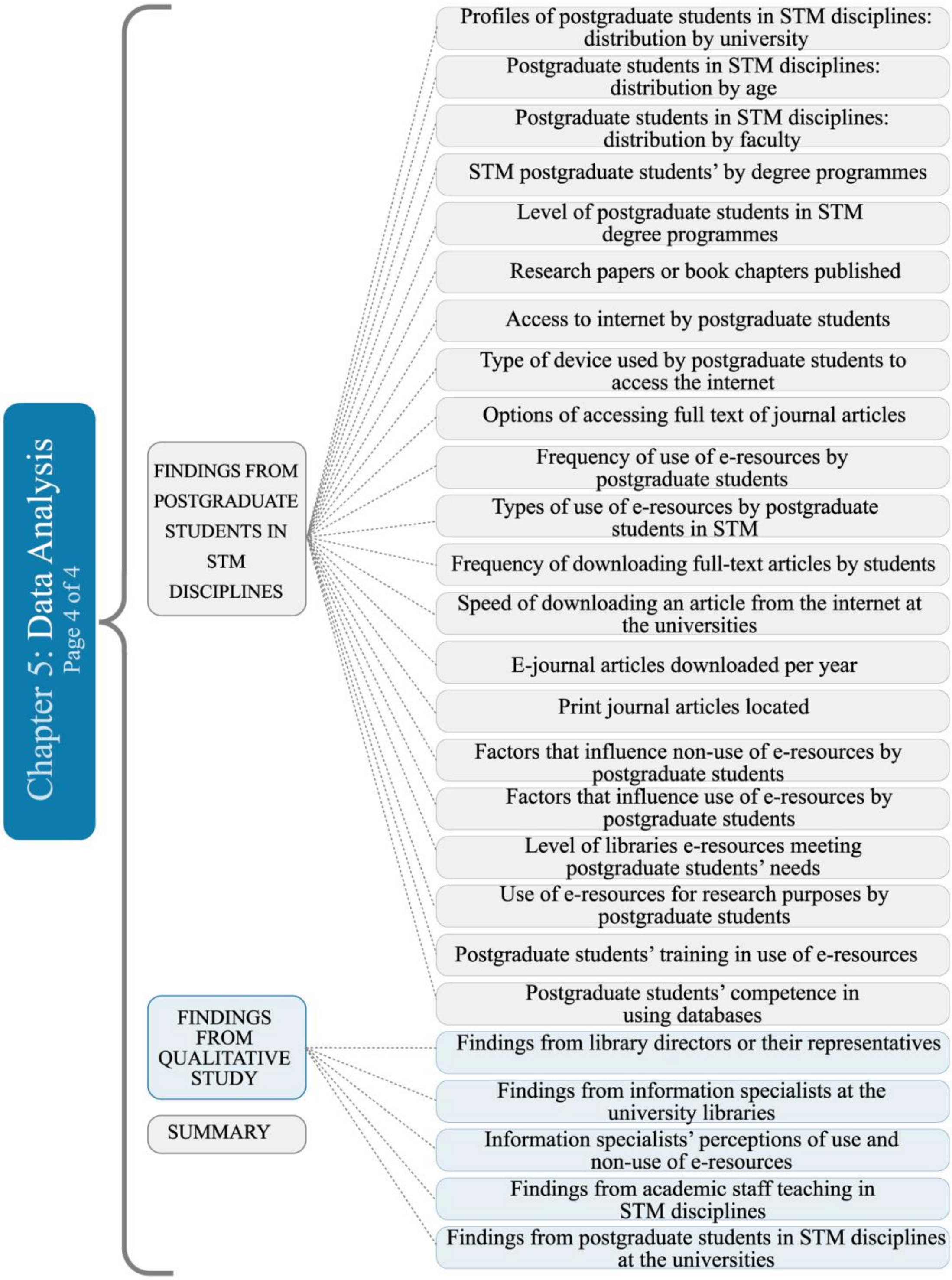
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SUMMARY

5.1 INTRODUCTION

This chapter covers the findings of the empirical component of the study. It also reiterates the purpose of the study, the research question and the research sub-questions to be answered from the empirical data. After a brief discussion of how the data were collected, the descriptive statistical findings, and findings from the limited qualitative data, are presented for the various groups from whom data were collected, namely the library directors or their representatives, in order to show the profile of the libraries and e-resources available at the institutions, the information specialists reporting on the resources and the training provided by the libraries to the academic staff and students, and the data collected from the academic staff and postgraduate students.

In each section the data presentation is based on the sections and questions in the questionnaires. The questionnaires are attached as Appendices 1,2, 3 and 4 at the end of the thesis (Appendix 1 = Questionnaire for library directors or their representatives; Appendix 2 = Questionnaire for information specialists responsible for e-resources; Appendix 3 = Questionnaire for academic staff teaching in STM disciplines and Appendix 4 = Questionnaire for postgraduate (master's and doctoral) students enrolled in the STM disciplines.) Sections 5.2 to 5.5 report on the descriptive quantitative data, and section 5.6 covers the qualitative data. The findings presented in this chapter are interpreted in Chapter 6. Chapter 7 covers the inferential statistical data analysis.

5.1.1 Purpose of study

As stated in Chapter 1, the purpose of this study was to investigate the factors affecting the use and non-use of e-resources by information specialists, academic staff and postgraduate students at universities in Zimbabwe involved with the STM disciplines. The focus was on low-cost and free library e-resources. The purpose was to find and recommend effective ways to promote and encourage the use of the scholarly resources by academic staff and postgraduate students at universities.

5.1.2 Research question and sub-questions

The research question guiding the study was to investigate factors affecting the use and non-use of free and low-cost library e-resources by information specialists, academic staff and post-graduate students in STM disciplines at universities in Zimbabwe (also stated in section 1.3 and discussed in section 4.1.2).

The following sub-questions (i, iv, v, and vi) had to be answered from the empirical component:

i. What is the *status quo* of free and low-cost e-resources available at universities in Zimbabwe?

iv. Which factors are influencing academic staff, postgraduate students and information specialists' *access* to e-resources in STM disciplines at universities in Zimbabwe?

v. Which factors are influencing academic staff and information specialists' *use* of e-resources at Zimbabwean universities in the STM disciplines?

vi. How can the use of e-resources at universities in Zimbabwe be effectively promoted in order to increase the use of these resources by academic staff and information specialists at these universities?

5. 2 SUMMARY OF METHOD OF CONDUCTING THE STUDY

5.2.1 Data collection

Data were collected during the period May to July 2015 at five universities in Zimbabwe offering postgraduate programmes in STM disciplines, namely agriculture, science and technology, medicine or health, environment sciences, natural sciences and veterinary science. Permission was sought from and granted by the Committee for Research Ethics and Integrity, Faculty of Engineering, Built Environment and Information Technology (EBIT) at the University of Pretoria before the data collection (See Appendix 5). The researcher also received written permission from each of the institutions concerned to do the data collection. See Appendices 7 to 10. The researcher, with the assistance of two enumerators, visited the universities and handed out the questionnaires with the assistance of contacts in the libraries arranged with the library directors and in liaison with academic staff. Print-based self-administered questionnaires were used to collect data. The questionnaires were then collected from the people who handed them out.

Several problems were experienced that affected data collection. Some questionnaires handed out to the targeted groups were not filled in or returned. Participants did not always respond to all questions, so N is not always the same. Up to three follow-up visits per institution were made by the researcher and enumerators from May to July 2015, which helped in getting the filled-in questionnaires mainly from postgraduate students. Academic staff were most difficult to make appointments with, as some indicated that they were too busy to fill in the questionnaire or refused to fill in the questionnaires or were away from their offices when the researcher visited the institutions. At Midlands State University (MSU) and Africa University (AU) the postgraduate students were reported to be away doing fieldwork during the time of the study. Efforts to get them to respond to the questionnaires each time they visited the campuses from the field visits proved fruitful.

5.2.2 Participants: Institutions and participatory groups

Data were collected from the following institutions: Africa University (AU), Chinhoyi University of Technology (CUT), Midlands State University (MSU), National University of Science and Technology (NUST) and University of Zimbabwe (UZ) (In presenting findings, especially tables and figures, only the acronyms will be used). Table 5.1 presents data on the number of people approached at each institution from the different groups, the number of those who participated and the numbers that did not return the questionnaires.

Table 5.1 Data collection at the five universities

Overall response and participation	Number of people approached	Number of returned questionnaires	Number that did not complete the questionnaire
Library directors at the universities	5	4	1
Information specialists charged with e-resources	40	38	2
Academic staff teaching in STM disciplines	150	80	70
Postgraduate students in STM disciplines	450	136	314
AU			
Library director at the universities	1	1	0
Information specialists charged with e-resources	10	9	1
Academic staff teaching in STM disciplines	10	6	4
Postgraduate students in STM disciplines	60	20	40
CUT			
Library director at the universities	1	1	0
Information specialists charged with e-resources	6	6	0
Academic staff teaching in STM disciplines	12	4	8
Postgraduate students	33	29	4

in STM disciplines			
NUST			
Library director at the universities	1	1	0
Information specialists charged with e-resources	8	9	1
Academic staff teaching in STM disciplines	30	10	20
Postgraduate students in STM disciplines	50	20	30
UZ			
Library director at the universities	1	0	1
Information specialists charged with e-resources	4	4	0
Academic staff teaching in STM disciplines	120	47	73
Postgraduate students in STM disciplines	250	57	193
MSU			
Library director at the universities	1	1	0
Information specialists charged with e-resources	8	8	0
Academic staff teaching in STM disciplines	15	6	9
Postgraduate students in STM disciplines	100	35	65

The following sections detail the findings of the quantitative study per participant group, starting with the library directors.

5.3 FINDINGS FROM LIBRARY DIRECTORS

This section outlines the data from the directors of libraries or their representatives. (Appendix 1: Questionnaire for each participating library: Library directors or their representatives). The presentations explain results on profiles of the libraries, their collections, internet access in the libraries, actual use of the e-resources at the libraries and e-resources training. Tables and figures have been presented on some data sets to clarify the data analysis results (where not necessary, only the figure or table is presented). The relevant questions are referenced in each of the following sections.

5.3.1 Respondents by university

Library directors at each of the five universities offering STM programmes were approached and asked to identify their university (Question 1, Appendix 1). Four of the five directors or their representatives returned the filled in questionnaires. They were from AU, CUT, MSU and NUST. The director or a representative from UZ could not participate.

5.3.2 STM disciplines supported by libraries

When asked to indicate the STM disciplines that their libraries supported (Question 2, Appendix 1), the four libraries that responded supported science and technology, medicine or health, environment and natural sciences faculties or schools. The specific disciplines covered in their e-resource collection and services are shown in Table 5.2.

Table 5.2 STM disciplines supported by the libraries

Discipline	Number of libraries (*N=4*)
Agriculture	Three out of four libraries supported agriculture faculties
Science and Technology	All four libraries supported science and technology faculties
Medicine or Health	Three out of four libraries supported medicine or health faculties
Environment	All four libraries supported environment faculties
Natural Sciences	All four universities had natural sciences faculties

5.3.3 Number of library users

When the directors were asked to indicate number of library users (Question 3, Appendix 1) the results showed that the number of users ranged from a minimum of 4 200 to a maximum of 20 810. The mean was 10 502 and the standard deviation was 7 176 (Table 5.3, below).

Table 5.3 Number of library users

N=4	
Mean	10 502
Lower Quartile	6 100
Median	8 500
Upper Quartile	14 905
Std Dev	7 176
Minimum	4 200
Maximum	20 810

5.3.4 Academic staff using the libraries

When asked to indicate the number of library users who were academic staff (Question 4, Appendix 1), recorded data from the libraries indicated that the number of academic staff using the libraries ranged from a minimum of 99 to a maximum of 500. The mean was 352 with a standard deviation of 182 (Table 5.4 below).

It should be noted that it was not considered at the time of setting the instruments to cover other groups using the library.

Table 5.4 Number of academic staff using the libraries

N=4	
Mean	352
Lower Quartile	220
Median	405
Upper Quartile	485
Std Dev	182
Minimum	99
Maximum	500

5.3.5 Number of library staff at the libraries

Table 5.5 below shows that the number of library staff ranged from a minimum of 19 to a maximum of 54. The mean was 41, with a standard deviation of 19.16 (Question 5, Appendix 1).

Table 5.5 Number of library staff

N=3	
Mean	41
Lower Quartile	19
Median	50
Upper Quartile	54
Std Dev	19.16
Minimum	19
Maximum	54

5.3.6 Number of information specialists in the libraries

Table 5.6 below shows the number of staff regarded as information specialists for purposes of this study (i.e. librarians with responsibility for e-resources at the libraries) at the participating libraries (Question 6, Appendix 1). The staff numbers ranged from a minimum of nine to a maximum of 20. The mean was 13 with a standard deviation of 4.99.

Table 5.6 Number of information specialists

N=4	
Mean	13
Lower	10
Median	12
Upper Quartile	17
Std Dev	4.99
Minimum	9
Maximum	20

5.3.7 Library collections

Table 5.7 present the library collection data from four university libraries (Question 7, Appendix 1). The NUST library had the largest collection in terms of e-resources (i.e. e-journals, e-books and theses or dissertations in electronic format).

Table 5.7 Number of library items by university

Library collection (*N=4*)	**Print books**	**E-books**	**Journal titles (print only)**	**Journal titles (electronic only)**	**Theses or dissertations (print)**	**Theses or dissertations (electronic)**
CUT	38 962	20	25	57	-	-
AU	63 000	120 000	25	7 500	400	326
MSU	70 000	160 000	363	20 000	2 800	1 000
NUST	96 417	928 336	-	200 000	10 000	3 601

Table 5.8 below shows that e-resources constituted a large part of the collections at the four universities with ranges of up to 200 000 e-journal titles and a mean of 137 e-journal titles accessible through various databases (Question 7, Appendix 1). E-books had ranges from just 20 to 928 336, with a mean of 302 089. The number of electronic theses or dissertations ranged from 326 to 3 601, with a mean of 1 642. This also shows considerable discrepancies between the collections of participating institutions.

Table 5.8 Number of library items by type

Type of collection	*N*	Mean	Lower quartile	Median	Upper quartile	Std Dev	Min.	Max.
Print books	4	67 095	50 981	66 500	83 209	23 639	38 962	96 417
E-books	4	302 089	60 010	140 000	544 168	422 995	20	928 336
Journal titles (print only)	3	137	25	25	363	195	25	363
Journal titles (electronic only)	4	56 889	3 778	13 750	110 000	95 761	57	200 000
Theses/dissertations (print)	3	4 400	400	2 800	10 000	4 996	400	10 000
Theses/dissertations (electronic)	3	1 642	326	1 000	3 601	1 729	326	3 601

5.3.8 Budgets for library collection development for 2015

Table 5.9 below shows the distribution of the library budget sizes reported for 2015 at the universities in US dollars (Question 8, Appendix 1). The amounts ranged from a minimum of \$100 000 to a maximum of \$455 000. The mean was \$300 500 with a standard deviation of \$178 543.

Table 5.9 Budgets for library collections

N=4	$
Mean	300 500
Lower Quartile	150 000
Median	323 500
Upper Quartile	451 000
Std Dev	178 543
Minimum	100 000
Maximum	455 000

5.3.9 Library search tools provided by the libraries to users

Respondents were asked to indicate which of the electronic library search tools were provided by the libraries (Question 10, Appendix 1). The results in Table 5.10 below showed that all four libraries provided OPAC, bibliographic, full-text and journal databases and institutional repositories. Only two of the libraries provided federated search engine or discovery tools (e.g. Libhub).

Table 5.10 Library search tools provided by libraries

Electronic library search tools provided by libraries	Yes	No	*N*
None of these	-	-	
OPAC	4	-	4
Bibliographic, full-text and journal databases (e.g. CAB Abstracts, PubMed, Agricola, EBSCO Host, Emerald)	4	-	4
Institutional repository	4	-	4
Federated search engines or discovery tool (e.g. Libhub)	2	2	4

5.3.10 E-resources provided by libraries to users

Table 5.11 below presents the databases the libraries indicated they provided to their users. EBSCO Host, Emerald, HINARI, JSTOR and TEEAL were provided by all four libraries (Question 11, Appendix 1).

Table 5.11 E-resources provided by libraries

Number of libraries that provided e-resources			
	Yes	No	*N*
AGORA	3	-	3
BioMed Central	2	1	3
CAB Abstracts	2	-	2
EBSCO Host	4	-	4
Emerald	4	-	4
HIGHWIRE	1	1	2
HINARI	4	-	4
JSTOR	4	-	4
OARE	2	-	2
PubMed	2	1	3
TEEAL	4	-	4

5.3.11 Access to full-text articles provided by the libraries

Table 5.12 and Figure 5.1 show the perception of library directors of how well their libraries provided access to the full-text articles needed by users through print, electronic and inter-library services (Question 12, Appendix 1).

All four libraries reported that they provided good access to full-text articles through electronic services. Provision of full-text articles via inter-library service was reported to be *poor* at two of the libraries.

Table 5.12 Access to full-text articles provided by libraries

N=4	Very poor	Poor	Fair	Good	Very good
Print	-	-	1	1	2
Electronic	-	-	-	4	-
Inter-library	-	2	-	1	1

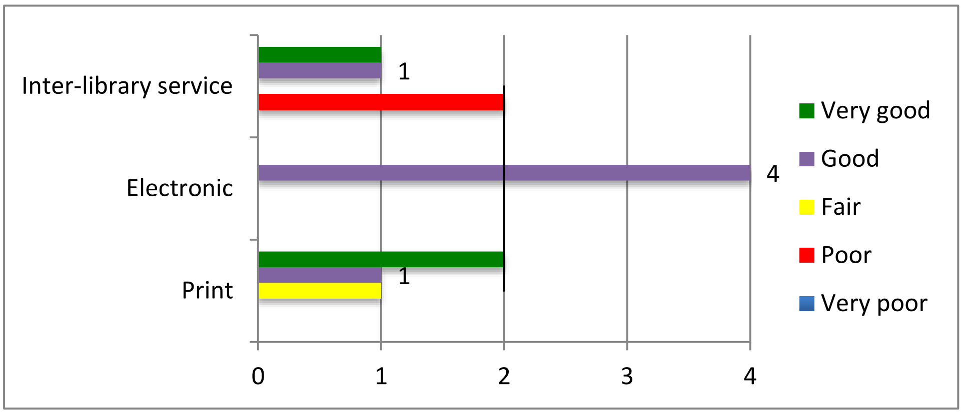


Figure 5.1 Access to full-text articles provided by libraries

5.3.12 Databases available to users off campus provided by the libraries

Asked to estimate the percentage of electronic databases that are available off campus, only three libraries indicated that they provided off-campus access to their journal databases (Question 13, Appendix 1). One provided only 4% of the databases, while the other two libraries provided 100% access to their users off campus. The fourth library did not respond to this question.

5.3.13 Internet speed at the libraries

Asked to rate the internet speed in the libraries (Question 16, Appendix 1), three of the library directors rated the internet access speed in their library as *very fast*, while the fourth rated it as *fast* (Table 5.13).

Table 5.13 Internet speed at the libraries

Internet speed at the libraries				
N=4	F	%	Cumulative F	Cumulative %
Very slow	-	-	-	-
Slow	-	-	-	-
Medium	-	-	-	-
Fast	1	25	1	25
Very fast	3	75	4	100

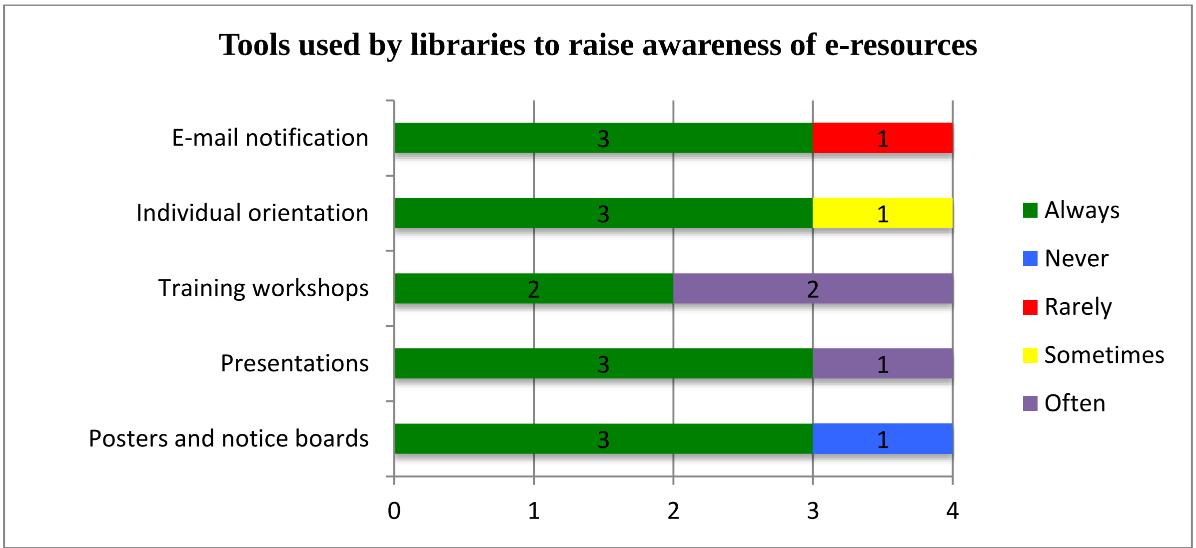
5.3.14 Efforts to raise awareness of e-resources

Respondents were asked how the libraries had raised awareness of the use of e-resources in the past two years among academic staff (Question 20, Appendix 1). As presented in Table 5.14 and Figure 5.2 below, three of the libraries *always* used e-mail notifications, individual orientation, presentations and poster and notice boards, while only two institutions *always* used training workshops. The other two institutions reported that they had *often* used training workshops. One institution indicated that it *rarely* used e-mail notification.

Table 5.14 Communication tools used to raise awareness of e-resources

Awareness tools (*N=4)*	Never	Rarely	Sometimes	Often	Always
Posters and notice boards	1	-	-	-	3
Presentations	-	-	-	1	3
Training workshops	-	-	-	2	2
Individual orientation	-	-	1	-	3
E-mail notification	-	1	-	-	3

Figure 5.2 Communication tools used to raise awareness of e-resources



5.3.15 Library efforts to encourage access to e-resources at libraries

Asked how the libraries provided and encouraged access to electronic resources (Question 18, Appendix 1), Table 5.15 shows that four libraries reported that they used a website with links to electronic resources (e.g. catalogue, databases, e-journals, e-books), faculty-specific information and guidelines, discipline-specific information and guidelines, one-on-one training to library users, STM discipline-focused group training and discipline-focused group training efforts for other disciplines. One of the libraries indicated that they used all the above efforts.

Table 5.15 Library tools encouraging access to e-resources at libraries

Library tools used to encourage access and use of e-resources at the libraries	**Yes**	**No**	***N***
No efforts		-	-
Website with links to electronic resources (e.g. catalogue, databases, e-journals, e-books)	4		4
Faculty-specific information and guidelines on e-resources and information services	4		4
Discipline-specific information and guidelines on e-resources in STM disciplines	4		4
One-on-one training to library users	4		4
STM discipline-focused group training, i.e. focusing on a specific discipline/s	4		4
Discipline-focused group training, but not for STM disciplines	4		4
All of the above	1		1

5.4 FINDINGS FROM INFORMATION SPECIALISTS CHARGED WITH E-RESOURCES

This section outlines the data from information specialists charged with e-resources at the participating libraries. See Appendix 2: Questionnaire for information specialists responsible for e-resources in the library. Of the 40 information specialists approached, 38 returned filled-in questionnaires. The figures and tables explain data on participant's profiles, how they access the internet and use the available library e-resources, as well as the factors that influence the use and non-use of the e-resources, the training they have received on e-resources and their competences in the use of the e-resources. Tables and figures have been presented on some data sets to clarify the data analysis results (where not necessary, only the figure or table is presented). The applicable question numbers are referenced in each of the following sections.

5.4.1 Profiles of information specialists responsible for e-resources in libraries

Figure 5.3 and Table 5.16 below show the distribution of the information specialist respondents by university (Question 1, Appendix 2). Africa University (AU) yielded the largest number of information specialists (10/38, 26.32%), while the smallest number of respondents (6/38, 15.79%) came from Midlands State University (MSU) and University of Zimbabwe (UZ) (6/38, 15.79%).

Figure 5.3 Information specialists responsible for e-resources by university

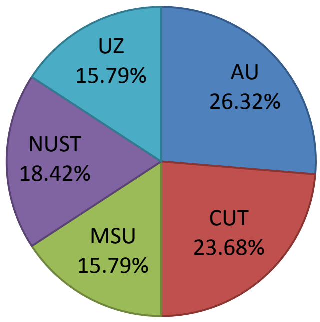


Table 5.16 Information specialists responsible for e-resources by university

Information specialists: distribution by university (*N=38*)				
Institution	**F**	**%**	**Cumulative F**	**Cumulative %**
AU	10	26.32	10	26.32
CUT	9	23.68	19	50
MSU	6	15.79	25	65.79
NUST	7	18.42	32	84.21
UZ	6	15.79	38	100

5.4.2 Information specialists: distribution by age

The descriptive statistics for age ranges of respondents are shown in Figure 5.4 and Table 5.17 below (Question 2, Appendix 2). The ages of information specialists responsible for e-resources ranged from a minimum of 27 years to a maximum of 53, a range of 26 years. In the investigation the majority of the respondents were in the age range 34-40 years (14/35, 40%), while 10/35 (28.57%) of the respondents’ ages fell in the 41-53 years range. The mean age was 37.46 years, with a standard deviation of 6.13 years. None were older than 53.

Figure 5.4 Information specialists' distribution by age

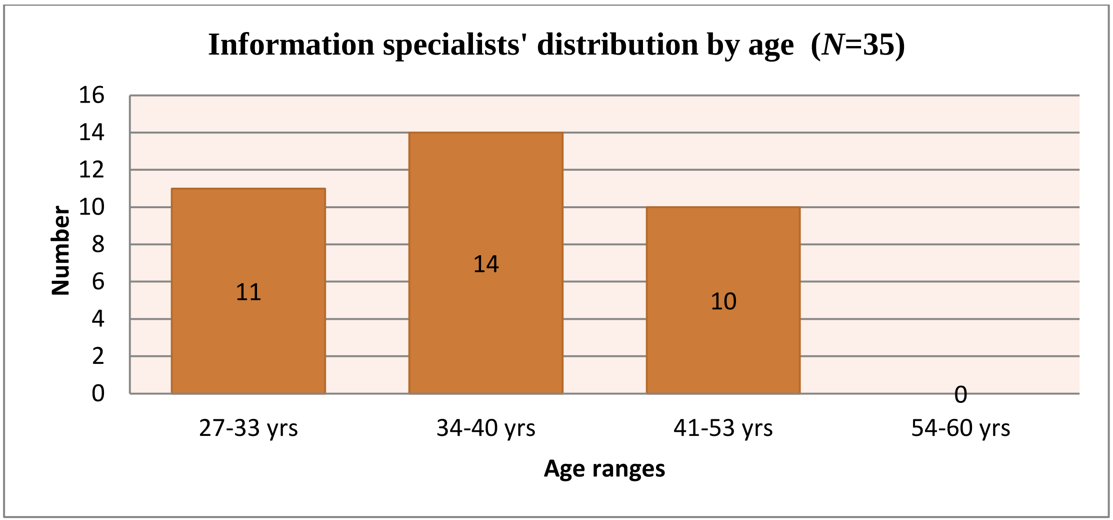


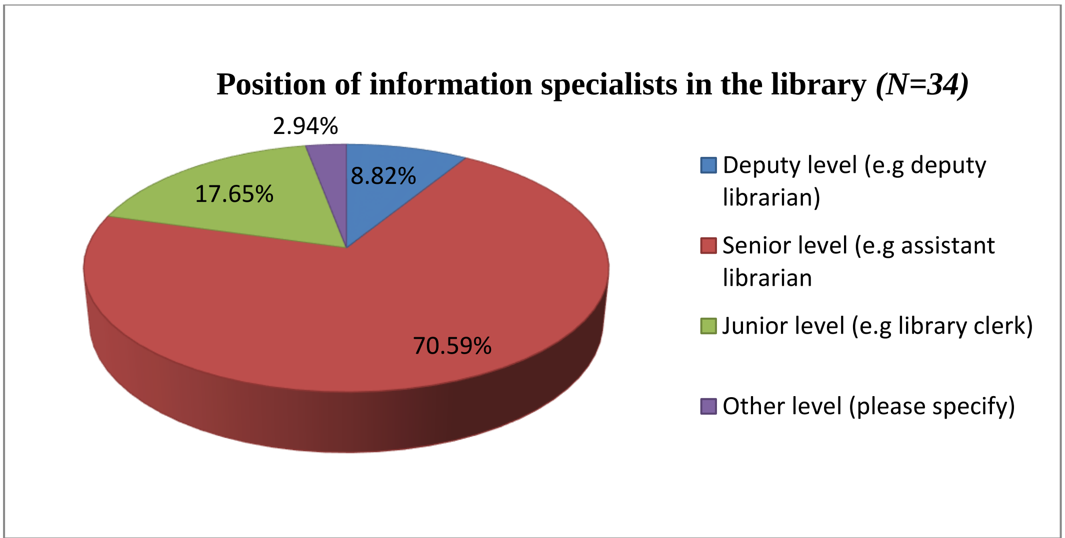
Table 5.17 Information specialists' distribution by age

Information specialist respondents' age		
***N*=35**		
Age ranges	**F**	**%**
27 - 33 years	11	31.43
34 - 40 years	14	40
41 - 53 years	10	28.57
54 - 60 years	0	0

5.4.3 Positions of the information specialists responsible for e-resources

Figure 5.5 below presents the results from an investigation on the position of information specialist respondents (Question 3, Appendix 2). The results show that the majority of the respondents were at senior level, e.g. assistant librarian (24/34, 70.59%), while 3/34 (8.82%) indicated that they were at deputy level (e.g. deputy librarian).

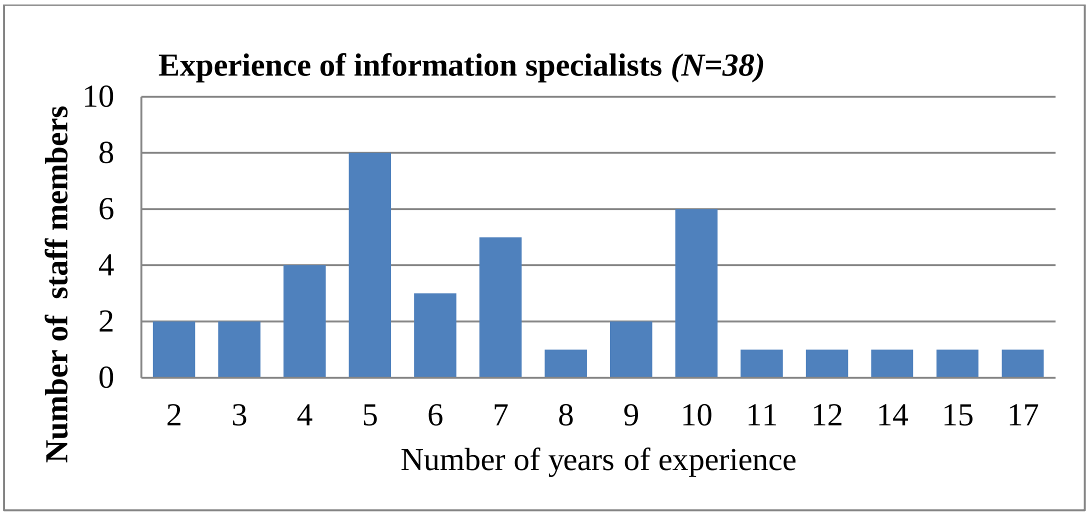
Figure 5.5 Position of the information specialists' respondents



5.4.4 Information specialists' experience

Figure 5.6 below presents varied experience levels in years for information specialists at the libraries (Question 4, Appendix 2). In the figure, only the actual years mentioned by the respondents are indicated, not the sequential years. The majority of the respondents, eight staff members, had five years' experience (8/38, 21.05%), followed by six who had six years' experience (6/38, 15.79.%). The mean was 7.21 years and the standard deviation was 3.56 years.

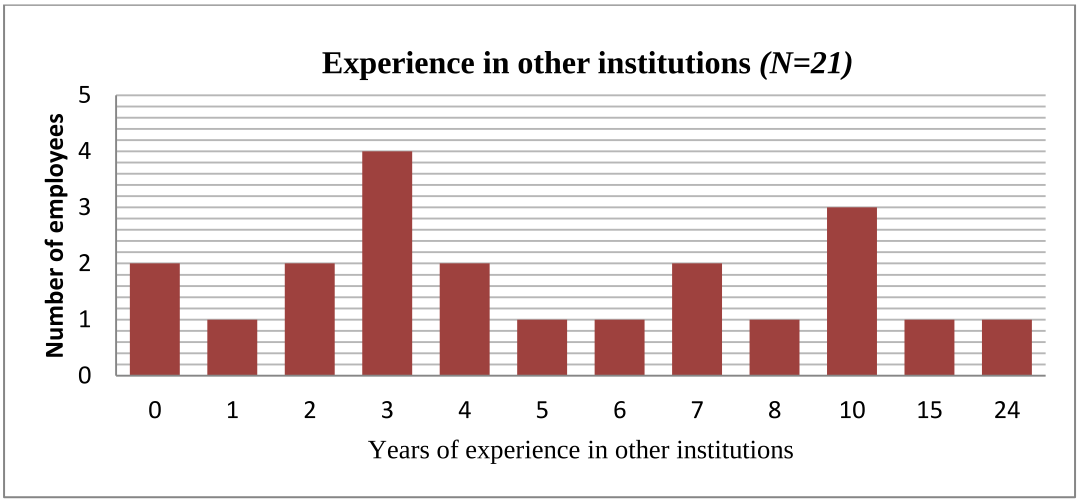
Figure 5.6 Information specialists' experience



5.4.5 Information specialists' years of experience in other institutions

Figure 5.7 below shows the distribution of years of experience of the information specialists at other institutions (Question 5, Appendix 2). The figure only indicates the actual years mentioned by the respondents, not sequential years. The majority of the information specialist respondents (4/21, 19.04%) had three years' experience in other institutions. Two of the 21 information specialists (9.52%) who answered the question had seven years of experience working in other institutions.

Figure 5.7 Information specialists' years of experience in other institutions



5.4.6 Provision of information services to STM disciplines by information specialists

The information specialists were asked in which STM disciplines they provided information services (Question 6, Appendix 2). The participants were asked to respond to all options. The number of respondents were not always the same for each discipline. Table 5.18 presents the results. N indicates the number of respondents per discipline. The percentages per discipline indicate the number of respondents who indicated Yes or No to providing services per discipline.

The table shows that three quarters of information specialists (21/28, 75%) indicated that they provided services to the agricultural science discipline, while a majority of the respondents (22/28, 84.62%) provided information services to the environmental discipline (Table 5.18).

Table 5.18 Provision of services by information specialists to disciplines

Discipline		**Yes**		**No**	
	N	F	%	F	%
Agriculture	28	21	75	7	25
Science &	29	21	72.41	8	27.59
Medicine or Health	25	15	60	10	40
Environment	26	22	84.62	4	15.38
Natural Sciences	26	18	69.23	8	30.77
Veterinary Science	22	9	40.91	13	59.09
Other (please specify)	15	11	73.33	4	26.67

5.4.7 Teaching of information skills in STM disciplines by information specialists

Table 5.19 below displays the results of investigating the teaching of information skills to various STM disciplines by information specialists (Question 7, Appendix 2). The participants were asked to respond to all questions. The number of respondents were not always the same for each discipline. N indicates the number of respondents per discipline. The percentages per discipline indicate the number of respondents who indicated Yes or No to providing services per discipline.

Over half of the respondents (16/28, 57.14%) admitted to teaching information skills to the agriculture discipline, while (17/29, 58.62%) taught science and technology. Over a third (9/24, 37.50%) of the respondents indicated that they provided information skills to the medicine or health discipline.

For environmental sciences, about two thirds (16/25, 64%) of information specialists' respondents taught information skills in the discipline. While for the natural sciences discipline more than half (14/24, 58.33%) of the information specialists respondents confirmed teaching in the discipline. For the veterinary science discipline, only five of the 22 respondents (22.73%) reported teaching information skills in the discipline.

Table 5.19 Teaching of information skills in STM disciplines

Discipline	***N***	**Yes**		**No**	
		F	%	F	%
Agriculture	28	16	57.14	12	42.86
Science & Technology	29	17	58.62	12	41.38
Medicine/Health	24	9	37.50	15	62.50
Environment Sciences	25	16	64	9	36
Natural Sciences	24	14	58.33	10	41.67
Veterinary Science	22	5	22.73	17	77.27
None	13	5	38.46	8	61.54
Other (please specify)	14	10	71.43	4	28.57

5.4.8 Information specialists' highest qualification

Table 5.20 below shows the distribution of highest academic qualifications of information specialists responsible for e-resources (Question 9, Appendix 2). 38 information specialists answered the question. The majority of the information specialists had a bachelors' degree (16/38, 42.11%), followed by those with a master's degree (15/38, 39.47%). Four of the 38 respondents (10.53%) had a certificate or a diploma qualification and only three information specialists had a postgraduate diploma (3/38, 7.89%).

Table 5.20 Highest qualification in library or information science

Highest qualification	F	% total
N=38		
No qualification	-	-
Certificate or diploma	4	10.53
Bachelor's degree	16	42.11
Master's degree	15	39.47
Doctoral degree	3	7.89
Postgraduate diploma	-	-
		100%

5.4.9 Duties of information specialists responsible for e-resources in the library

When asked to indicate the duties included in their work (Question 10, Appendix 2), the information specialists responses are presented in Table 5.21. The number of respondents were not always the same as indicated by *N* for each option. Although they were expected to respond to all options, they often did not.

The results show that 29/33 (87.88%) of the respondents reported doing research as part of their duties, while the majority (31/36, 86.11%) responded that they had training as part of their duties. Seventeen out of 29 (58.62%) responded that teaching was part of their duties.

Table 5.21 Duties of information specialists responsible for e-resources in the library

Information specialist's duties	*N*	Yes		No	
		F	%	F	%
Research	33	29	87.88	4	12.12
Teaching	29	17	58.62	12	41.38
Training	36	31	86.11	5	13.89
Outreach	29	21	72.41	8	27.59
None	7	2	28.57	5	71.43

5.4.10 Access to internet

Table 5.22 below presents the results of an investigation to ascertain how the information specialists accessed the internet (Question 11, Appendix 2**)**. The respondents were asked to respond to all options. The number of respondents was not always the same as indicated by N per option.

A majority of the respondents (22/28, 78.57%) who responded to the option, indicated that they accessed the internet either at work or at home. Interestingly, only one respondent out of 21 (4.76%) who responded indicated accessing internet at home only. Almost half, 13 out of 27 (48.15%) who responded, reported accessing the internet at work only. Use of internet cafés to access the internet was reported by 13 out of 22 respondents (59.09%).

Table 5.22 Access to internet

Access to internet	***N***	**Yes**		**No**	
		F	%	F	%
Do not access the internet	20	-	-	20	100
Internet connection at home only	21	1	4.76	20	95.24
Internet connection at work only	27	13	48.15	14	51.85
Internet connection at work and home	28	22	78.57	6	21.43
Internet café	22	13	59.09	9	40.91

5.4.11 Type of device used by information specialists to access the internet

In investigating the type of device information specialists use to access the internet (Question 12, Appendix 2) the results presented in Figure 5.8 and Table 5.23 below were recorded.

The number of respondents were not always the same as indicated by N for each option. Although they were expected to respond to all options, they often did not. Sub-sections 5.3.11.1 to 5.3.11.4 explain the results for each of the devices. Data on the level of use for each device were grouped into four categories (0-30%), (31-50%), (51-70%) and (71-100%) with 0% being lowest and 100% highest usage.

Figure 5.8 Type of device used by information specialists to access the internet

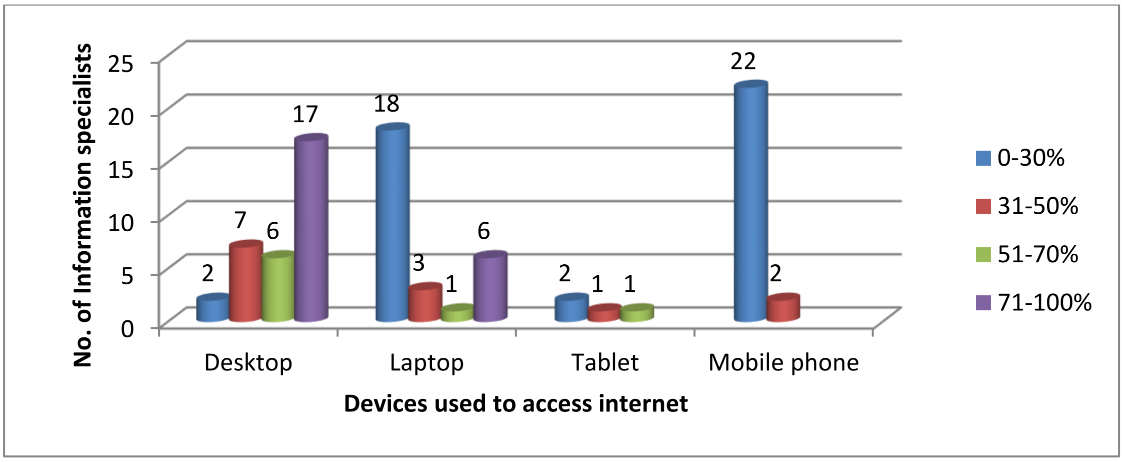


Table 5.23 Type of access used by information specialists to access the internet

Label	***N***	**Mean**	**Stand Dev**	**Minimum**	**Maximum**
Desktop computer	32	68.47	23.81	10	100
Laptop	28	38.32	31.56	2	100
Tablet (e.g. iPad, Galaxy)	4	31.25	27.8	5	60
Mobile	24	15.46	11.52	2	50

5.4.11.1 Desktop computer

Of the 32 respondents to this option, 7 of them (21.87%) used a desktop computer 31%-50% of the time when accessing the internet, while more than half of the respondents (17/32, 53.12%) made use of a desktop computer between 71% and 100% of the time when accessing the internet. The desktop use mean was 68.47% with a standard deviation of 23.81.

5.4.11.2 Laptop

Of the 28 respondents who picked this option, 18 of them (64.28%) used a laptop computer up to 30% of the time when accessing the internet, while 6 (21.42%) respondents used a laptop 71%-100% of the time. The laptop mean was 38.25% with a standard deviation of 31.56.

5.4.11.3 Tablet

Only four respondents picked this option. Of these, two indicated that they used a tablet up to 30% when accessing the internet; one used a tablet 31-50% of the time, and also one used a tablet up to about 70% of the times. The tablet mean was 31.25%, with a standard deviation of 27.8.

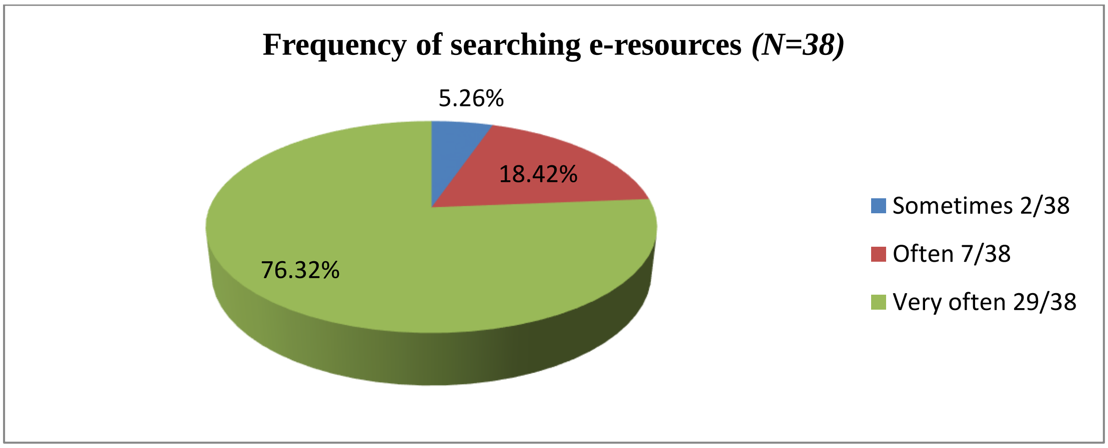
5.4.11.4 Mobile phone

Of the 24 respondents who picked this option, 22 (91.66%) used a mobile phone up to 30% when accessing the internet, while two respondents (8.33%) used a mobile phone 31%-50% of the time. Mobile phone use had a mean of 15.46% and a standard deviation of 11.52.

5.4.12 Frequency of searching library e-resources by information specialists

When asked how often the information specialists searched library e-resources, 38 information specialists responded (Question 13, Appendix 2). Figure 5.9 below presents the results. The results indicate that the majority of information specialists (29/38, 76.32%) searched the library e-resources *very often*; only a small minority of the information specialists (2/38, 5.26%) indicated that they searched the e-resources *sometimes*.

Figure 5.9 Frequency of searching library e-resources by information specialists



5.4.13 Information specialists' perception of importance of e-resources

Table 5.24 below displays information specialists' opinion on the importance of library e-resources (Question 14, Appendix 2). The number of respondents were not the same for each option as indicated in the table by N for each option.

A majority of information specialists were positive about the use of e-resources. 28 out of 38 respondents (73.68%) indicated that it was *very important* to use e-resources to find information on behalf of users. 31 out of 38 respondents (81.58%) indicated that it was *very important* to use e-resources for study purposes, while 27 out of 37 respondents (72.97%) indicated that it was *very important* to use e-resources for teaching and study purposes.

Table 5.24 Information specialists' perceptions of e-resources

E-resources	*N*	Not important at all		Low importance		Neutral		Important		Very important	
		F	%	F	%	F	%	F	%	F	%
To find information on behalf of users	38	-	-	-	-	1	2.63	9	23.68	28	73.68
For study purposes	38	-	-	-	-	-	-	7	18.42	31	81.58
For teaching and study purposes	37	-	-	-	-	2	5.41	8	21.62	27	72.97

5.4.14 Use of library e-resources by information specialists

The use of different e-resources by information specialists was also investigated (Question 15, Appendix 2) and the results are presented in Figure 5.10 and Table 5.25 below. As indicated in Table 5.25, the number of respondents were not always the same as indicated by N for each option.

The databases reported to be used most often were Emerald, with 33 out of 37 respondents (89,19%) indicating use *very often* and *often*, and EBSCO Host, with 29 out of 37 (78.37%) reporting that they used it *often* or *very often*. This was followed by JSTOR (26/36, 72.22%) and HINARI (24/37, 64.86%) and then the agriculture discipline only database, AGORA (21/36, 58.33%). It is interesting to note that CAB Abstracts was reported to be used *once in a while* by half the information specialists (16/34, 47.06%).

BioMed Central and HIGHWIRE were the databases reported to be used least *often*. For HIGHWIRE 15 of the 33 respondents (45.45%) indicated that they had *never* or *almost never* used the database, while for Biomed Central, 15 of the 34 respondents (44.12%), had *never* or *almost never* used the resource.

Figure 5.10 Frequency of use of e-resources by information specialists

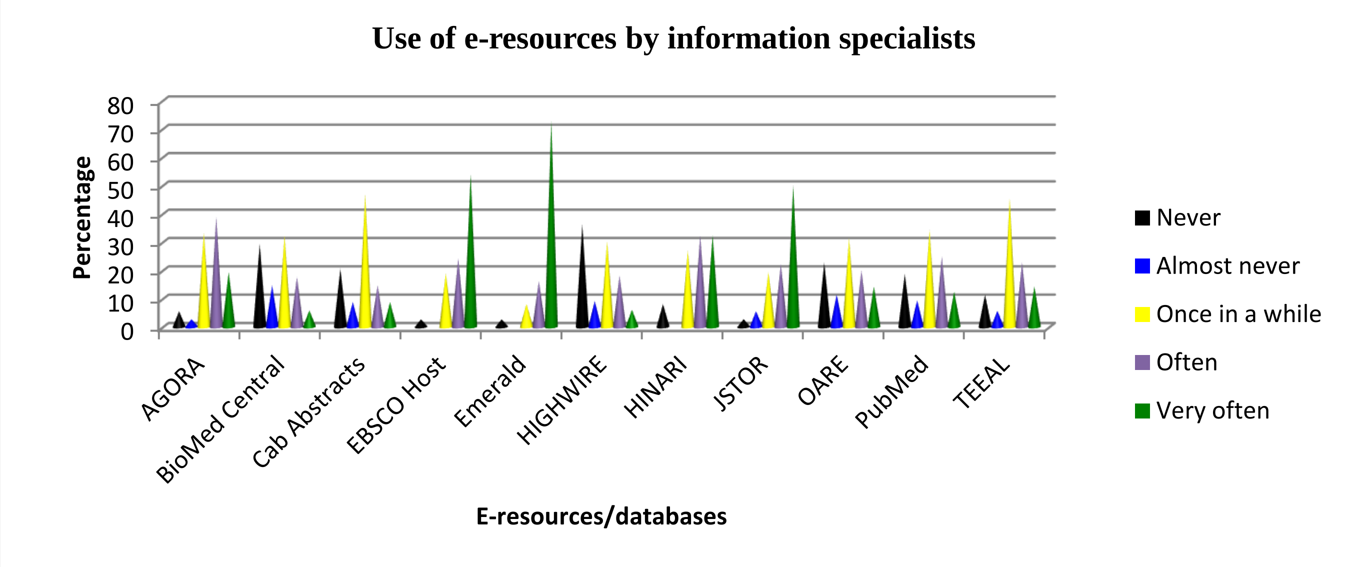


Table 5.25 Frequency of use of e-resources

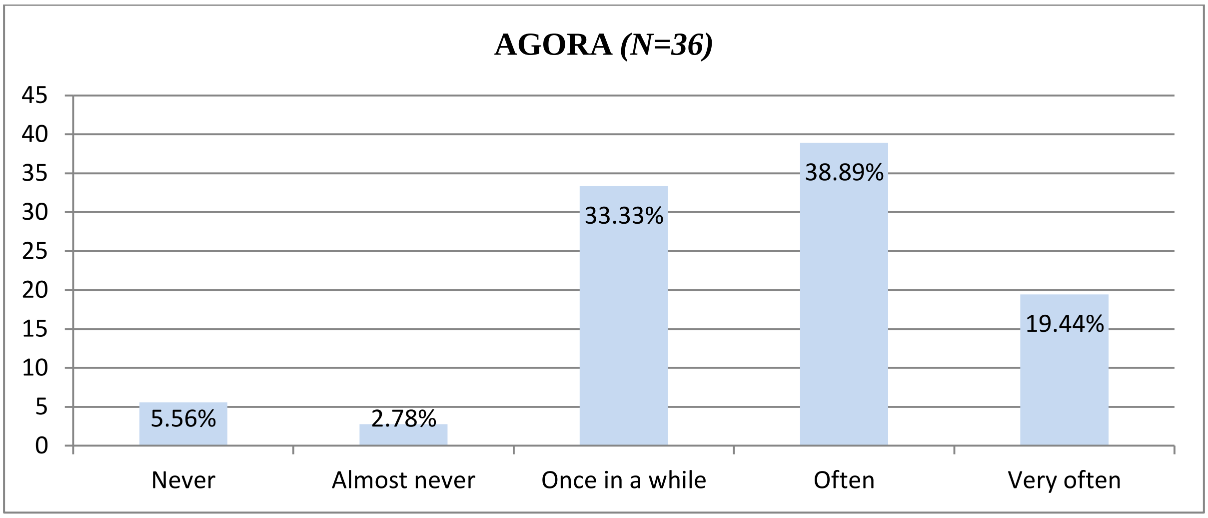
E-resources	***N***	**Never**		**Almost never**		**Once in a while**		**Often**		**Very often**	
		F	%	F	%	F	%	F	%	F	%
AGORA	36	2	5.56	1	2.78	12	33.33	14	38.89	7	19.44
BioMed Central	34	10	29.41	5	14.71	11	32.35	6	17.65	2	5.88
Cab Abstracts	34	7	20.59	3	8.82	16	47.06	5	14.71	3	8.82
EBSCO Host	37	1	2.70	-	-	7	18.92	9	24.32	20	54.05
Emerald	37	1	2.70	-	-	3	8.11	6	16.22	27	72.97
HIGHWIRE	33	12	36.36	3	9.09	10	30.30	6	18.18	2	6.06
HINARI	37	3	8.11	-	-	10	27.03	12	32.43	12	32.43
JSTOR	36	1	2.78	2	5.56	7	19.44	8	22.22	18	50
OARE	35	8	22.86	4	11.43	11	31.43	7	20	5	14.29
PubMed	32	6	18.75	3	9.38	11	34.38	8	25	4	12.50
TEEAL	35	4	11.43	2	5.71	16	45.71	8	22.86	5	14.29

The following section explains the results per e-resource/database and Figures 5.11 to 5.21 show the results for each of the e-resources in detail.

5.4.14.1 AGORA

For AGORA, 36 responded. The results shown in Figure 5.11 below reflect that over half (21/36, 58,33%) of the information specialists' respondents indicated that they used AGORA *often* or *very often*, while only three out of the 36 (8.33%) respondents had *never* used or *almost never* used AGORA.

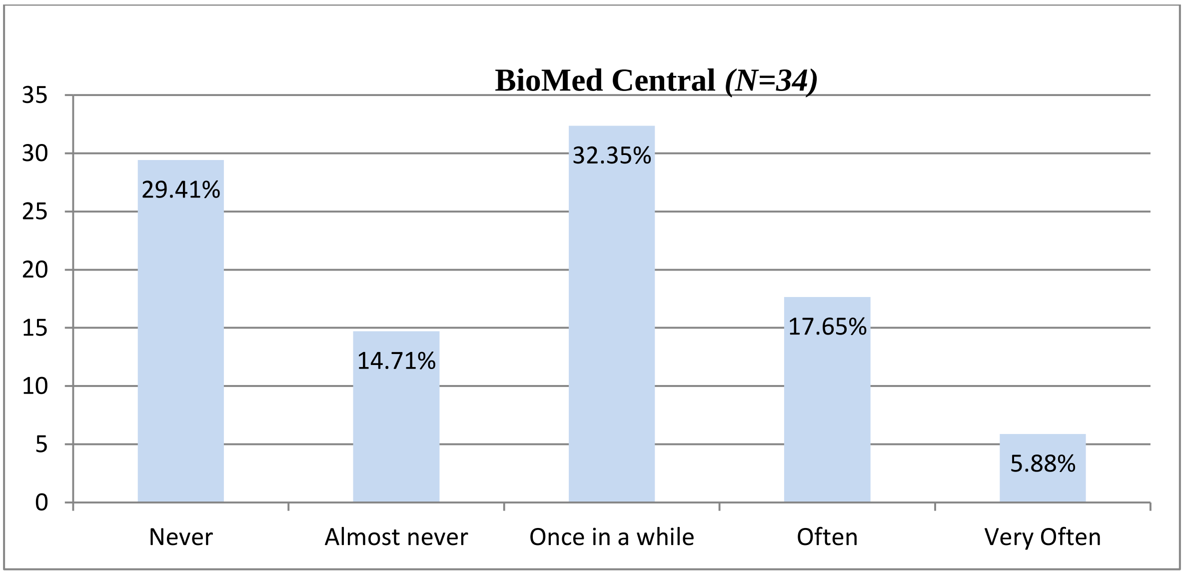
Figure 5.11 AGORA use by information specialists



5.4.14.2 BioMed Central

The results in Figure 5.12 below show that 10 of 34 (29.41%) of information specialists had *never* used BioMed Central, while almost a third (11/34, 32.35%) had used BioMed Central *once in a while*. Only 8 of 34 (23.53%) used it *often or very often.*

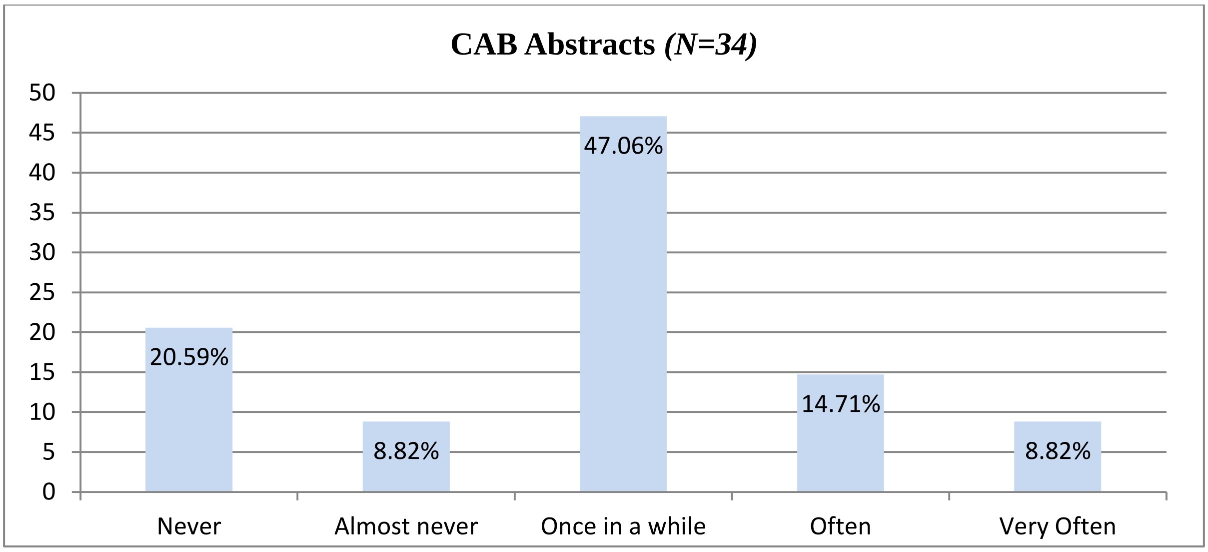
Figure 5.12 Use of Biomed Central by information specialists



5.4.14.3 CAB Abstracts

The results presented in Figure 5.13 below show that almost half (16/34, 47.06%) of the respondents had used CAB Abstracts *once in a while*, while three of the 34 respondents (8.82%) used the resource *very often*. Ten out of 34 (29.41%) *never* or *almost never* used it.

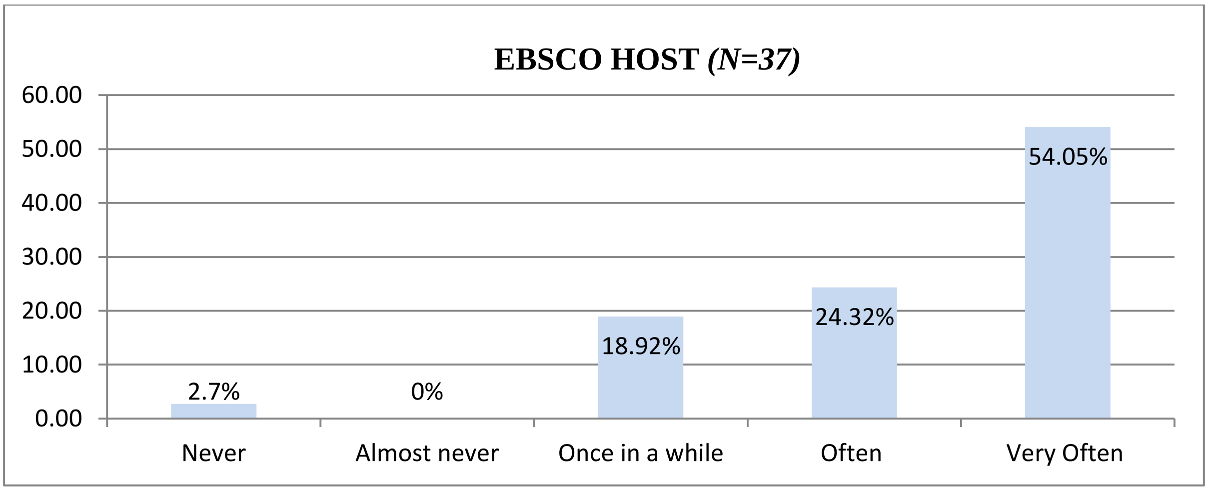
Figure 5.13 Use of CAB abstracts by information specialists



5.4.14.4 EBSCO Host

Figure 5.14 below shows results for the EBSCO Host database. Thirty-seven responded to this option. Twenty of the respondents (54.05%) used the EBSCO Host database *very often*, while only one respondent had *never* used it. In combination 29 out of 37 of the respondents (78.37%) used it *often* or *very often*.

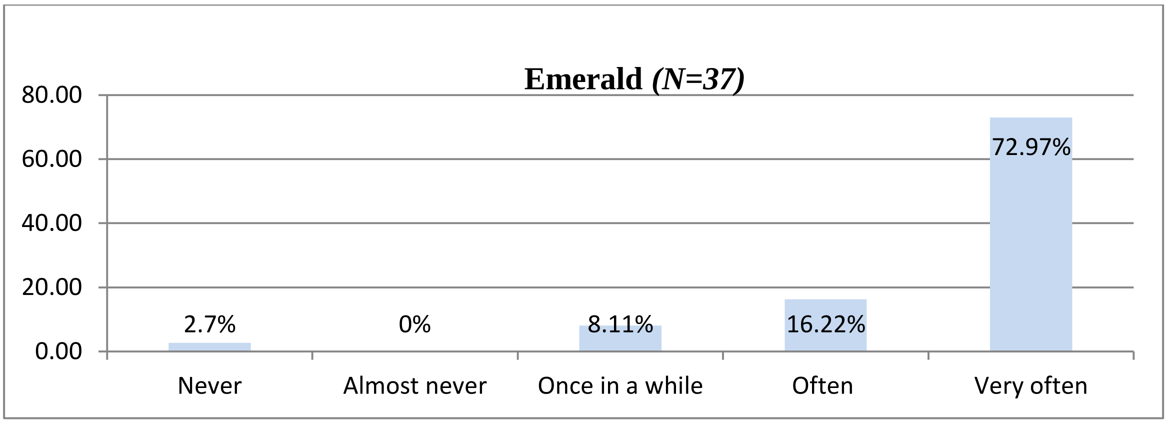
Figure 5.14 Use of EBSCO Host by information specialists



5.4.14.5 Emerald

Figure 5.15 below presents the results for the Emerald database. Out of the 37 respondents for this option, almost three quarters (27/37, 72.97%) used Emerald *very often*, while only one respondent (2.7%) reported that they had never used it. Thirty-three out of 37 (89.19%) *often* or *very often* used it.

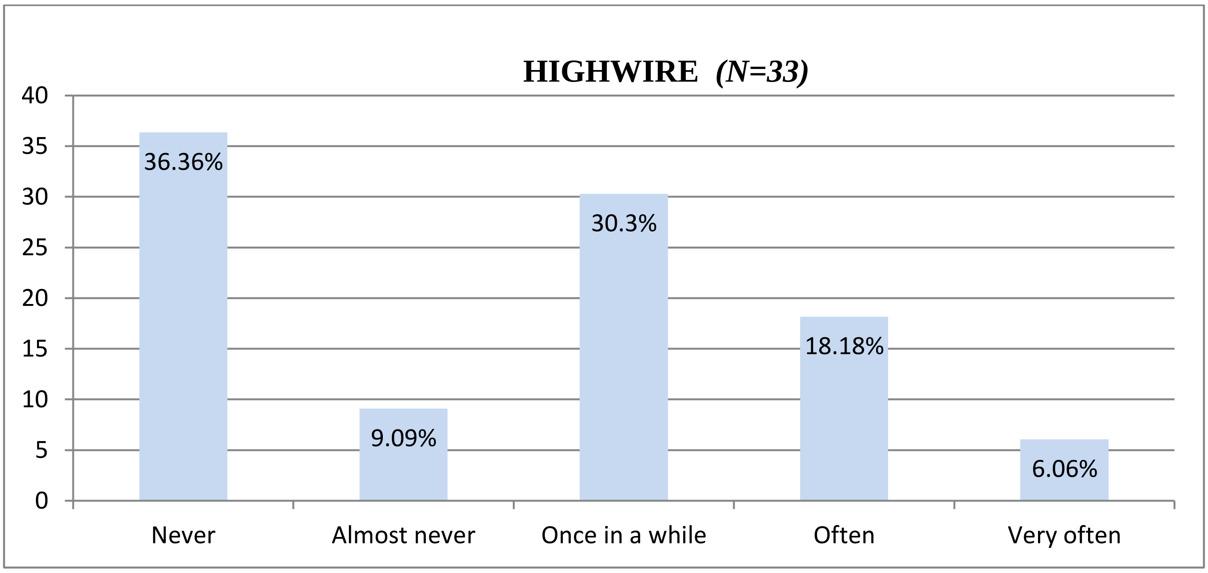
Figure 5.15 Use of Emerald by information specialists



5.4.14.6 HIGHWIRE

Figure 5.16 below shows that more than a third (12/33, 36.36%) of the information specialists had *never* used HIGHWIRE, while 10 of the 33 (30.3%) used the resource *once in a while*. Three of the 33 (9.09%) respondents *almost never* used HIGHWIRE. Only 8 out of 33 respondents (24.24%) used it *often* or *very often.*

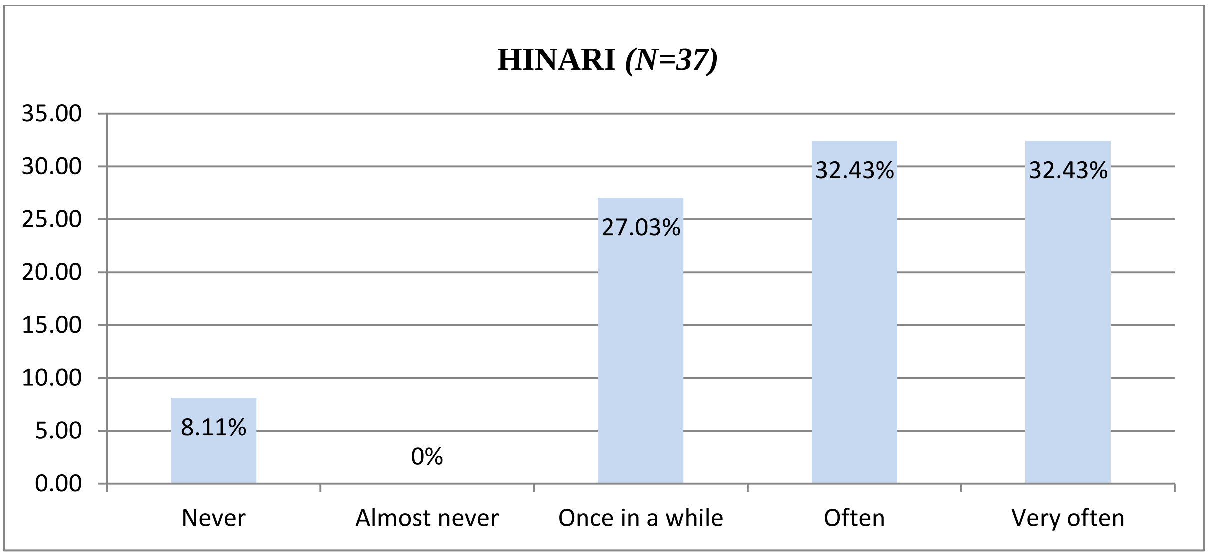
Figure 5.16 Use of HIGHWIRE by information specialists



5.4.14.7 HINARI

Results presented in Figure 5.17 below show that a third of the information specialists (12/37, 32.43%) used HINARI *often*, while only another third of the respondents (12/37, 32.43%) used the resource *very often*. Only three of the 37 respondents (8.11%) had never used HINARI. In combination, 24/37 (64.86%) used the database *often* or *very often*.

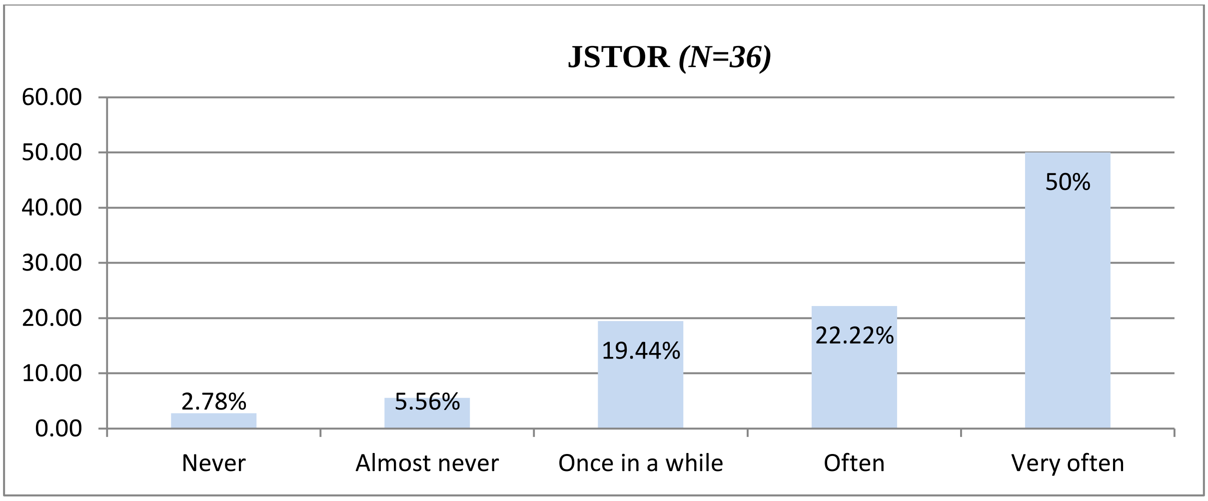
Figure 5.17 Use of HINARI by information specialists



5.4.14.8 JSTOR

The results presented in Figure 5.18 below show that only one out of the 36 of information specialists (2.78%) had *never* used JSTOR, while half of the respondents (18/36, 50%) reported that they *very often* used JSTOR. In combination, 26/36 (72.22%) respondents used it *often* or *very often.*

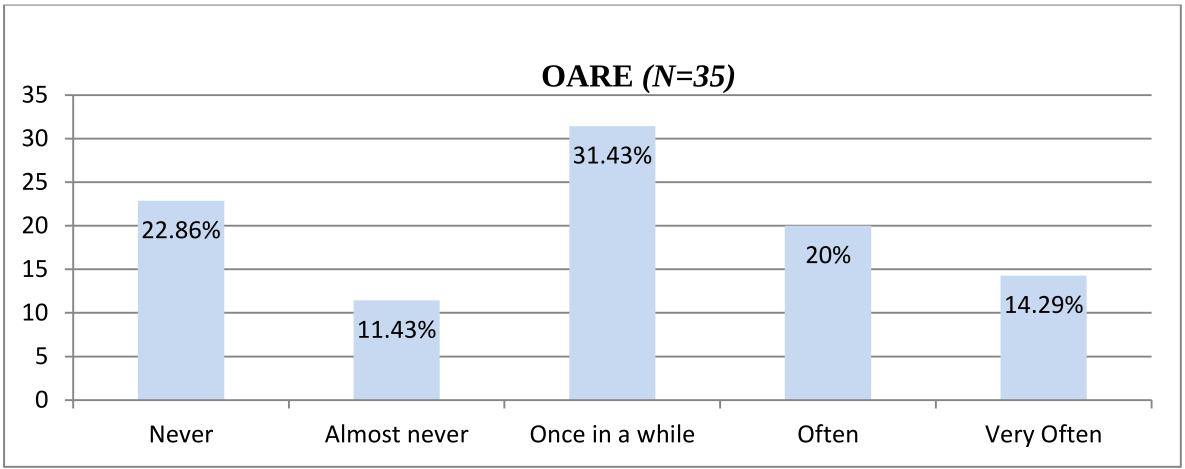
Figure 5.18 Use of JSTOR by information specialists



5.4.14.9 OARE

Figure 5.19 below displays the results on the use of OARE by information specialists. About a third (11/35, 31.43%) of respondents had used OARE *once in a while*, a fifth (7/35, 20%) of the respondents had *often* used it, while only five of the 35 (14.29%) had used OARE *very often*.

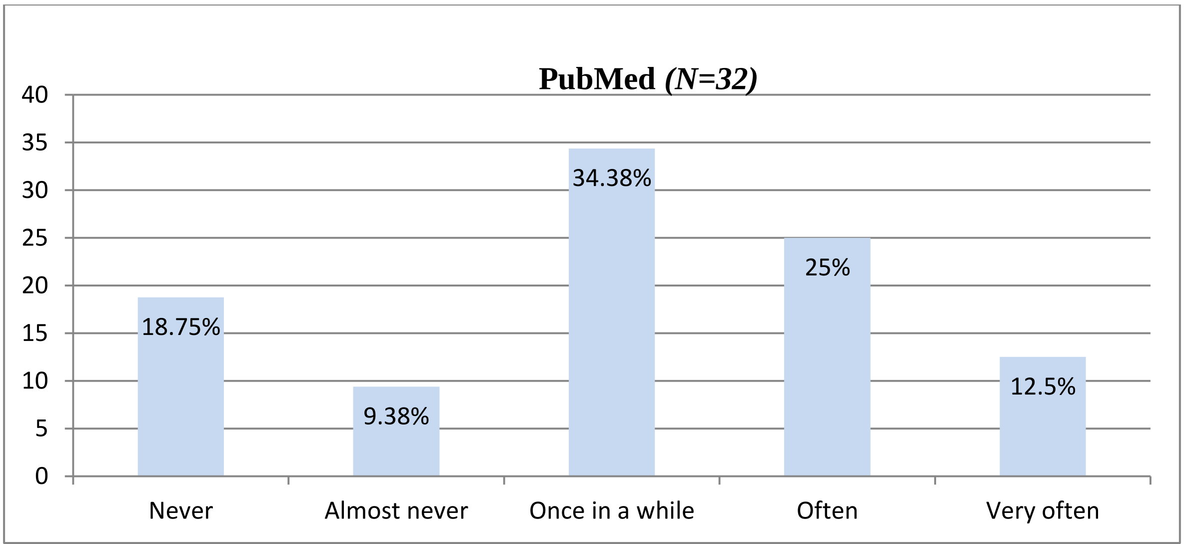
Figure 5.19 Use of OARE by postgraduate students



5.4.14.10 PubMed

Figure 5.20 below indicates that more than a third (11/32, 34.38%) of information specialists had used PubMed *once in a while*, while a quarter of the respondents (8/32, 25%) *often* used PubMed. Four out of the 32 respondents (12.50%) used the resource *very often*. In combination, 37.5% used it *often* or *very often*.

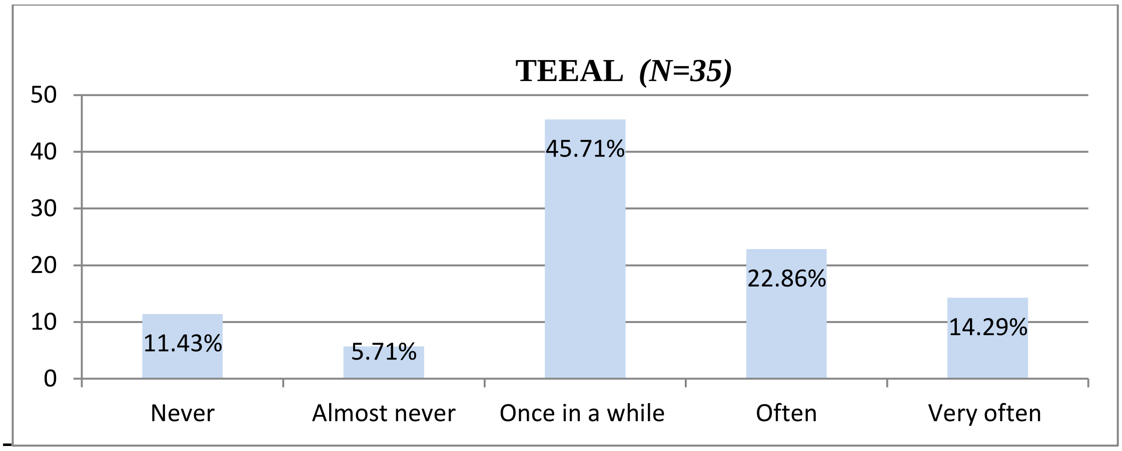
Figure 5.20 Use of PubMed by information specialists



5.4.14.11 TEEAL

Results presented in Figure 5.21 below show that about half (16/35, 45.71%) of the information specialists indicated that they had used TEEAL *once in a while*. Only six (17.14%) of the 35 respondents indicated that they had *never* or *almost never* used TEEAL. Thirteen out of 35 respondents (37, 14%) had used it *often* or *very often*.

Figure 5.21 Use of TEEAL by information specialists



5.4.15 Use of e-resources at work by information specialists

The information specialists were asked why they used e-resources for their work. Table 5.26 shows the findings on the question (Question 14, Appendix 2). Although respondents were expected to respond to all options, often they did not. N differs for each option and is indicated in the table. The detail is given in sections 5.4.15.1 to 5.4.15.14.

Table 5.26 Use of e-resources at work

Use of e-resources at work	*N*	Yes		No	
		F	%	F	%
I use e-resources for my work	24	24	100	-	-
To do searches on behalf of library users	38	37	97.37	1	2.36
To prepare for information literacy training	38	34	89.47	4	10.53
To support users with systematic literature reviews	35	32	91.43	3	8.57
To provide current awareness/alerting services to users	37	36	97.30	1	2.70
To run current awareness/alerting services for own benefit	35	33	94.29	2	5.71
To verify bibliographic detail	36	31	86.11	5	13.89
To prepare articles	34	26	76.47	8	23.53
To prepare papers for conferences	33	23	69.70	10	30.30
To write grant proposals	34	20	58.82	14	41.18
To build collections	34	29	85.29	5	14.71
To apply in users' citation analysis	36	28	77.78	8	22.22
To enable tracking usage/logs	35	28	80	7	20
To assist undergraduate students	37	37	100	-	-

5.4.15.1 Use e-resources for own work

Information specialists were asked if they use e-resources for their work. Twenty-four responded to this question and all respondents to the question (100%) reported that they used e-resources for their work.

5.4.15.2 Searching on behalf of library users

When asked if they do searches on behalf of their library users, there were 38 respondents. A majority of the respondents (37/38, 97.37%) confirmed that they used e-resources to do searches on behalf of library users.

5.4.15.3 Prepare for information literacy training

Asked if they used e-resources to prepare for information literacy training, a majority of information specialists (34/38, 89.47%) indicated that they used e-resources to prepare for information literacy training, while only four (10.53%) of the 38 respondents denied doing it.

5.4.15.4 Systematic literature reviews

For systematic literature reviews, most of the respondents (32/35, 91.43%) agreed that they used e-resources to support users with systematic literature reviews, while only three of the 35 respondents (8.57%) did not provide the services.

5.4.15.5 Provision of current awareness/alerting services

Almost all of the information specialist respondents (36/37, 97.30%) agreed that they provided current awareness or alerting services to users.

5.4.15.6 Awareness or alerting services for own benefit

A majority of respondents (33/35, 94.29%) indicated that they used e-resources to run current awareness or alerting services for their own benefit, while two of the 35 respondents (5.71%) indicated that they did not use e-resources to provide awareness services.

5.4.15.7 Verify bibliographic detail

Of the 36 respondents on use of e-resources to verify bibliographic detail, over three quarters of the respondents (31/36, 86.11%) confirmed that they used e-resources to verify bibliographic detail.

5.4.15.8 Preparing articles

Twenty-six out of 34 respondents (76.47%) indicated that they used e-resources to prepare articles, while eight of 34 (23.53%) said they did not.

5.4.15.9 Preparing papers for conferences

Over two thirds of the respondents (23/33, 69.70%) reported that they used e-resources to prepare papers for conferences, while 10 of the 33 (30.30%) did not.

5.4.15.10 Writing grant proposals

On using e-resources when writing grant proposals 20 of the 34 (58.82%) confirmed that they used e-resources to write grant proposals.

5.4.15.11 Collection building

The information specialists indicated that they used e-resources for collection building by a high margin (29/34, 85.29%).

5.4.15.12 Users' citation analysis

Three quarters (28/36, 77.78%) of the respondents agreed that they used e-resources for citation analysis and 8/36 (22.22%) said they did not.

5.4.15.13 Tracking usage/logs

A majority of the respondents' (28/35, 80%) used e-resources for tracking usage/logs, while (7/35, 20%) did not.

5.4.15.14 Assisting undergraduate students

As expected, all respondents to this option (37/37, 100%) reported that they used e-resources to assist undergraduate students.

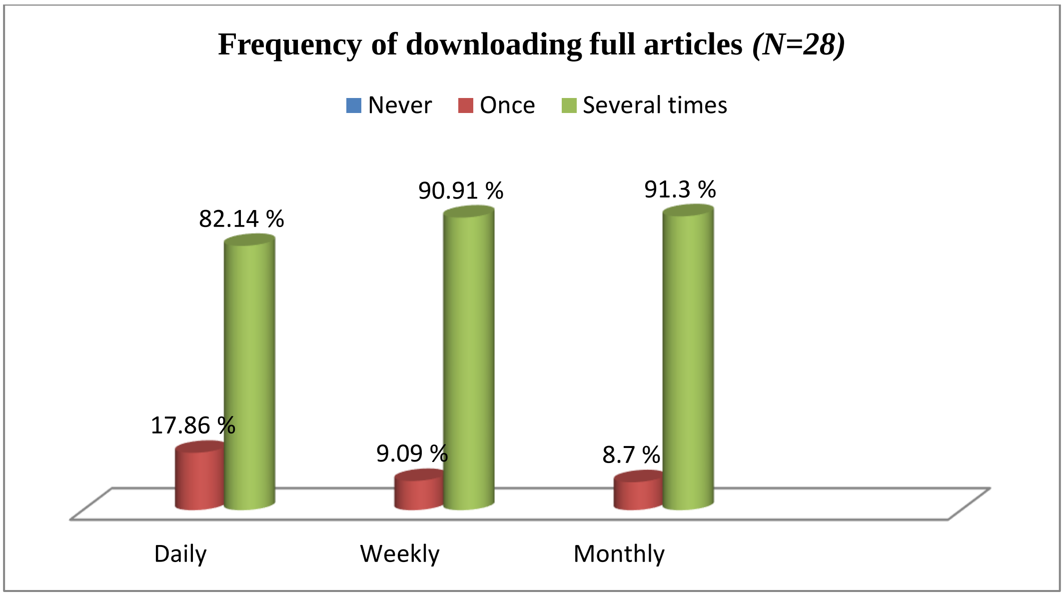
5.4.16 Frequency of downloading full-text articles by information specialists

Figure 5.22 below presents the results of the frequency with which information specialists downloaded full-text articles (Question 17, Appendix 2). N differs per option. Five of 28 of information specialist respondents (17.86%) reported that they downloaded full text articles *once daily*, while 23 of 28 (82.14%) respondents downloaded full text articles *several times daily*.

Two of 22 respondents (9.09%) downloaded full text articles *once weekly*, with 20 of 22 respondents (90.91%) downloading full text articles *several times weekly*.

The findings also show that two of 23 respondents (8.70%) downloaded full text articles *once a month*, while a majority of respondents (21/23, 91.93%) indicated that they downloaded full text articles of e-resources *several times a month*.

Figure 5.22 Frequency of downloading full articles by information specialists



5.4.17 Speed of downloading articles from the internet at the universities

In investigating the overall impression of information specialists of the average speed of downloading articles from the internet (Question 18, Appendix 2), there were 37 respondents. Table 5.27 and Figure 5.22 show that a majority of the information specialists' impression of the average speed of downloading an article from the internet at the universities was either *fast* (17/37, 45.95%) or *very fast* (6/37, 16.22%). Only three (8.11%) of 37 of the respondents reported the speed of the internet to be *slow*. None of the respondents reported the speed to be *very slow*.

Table 5.27 Speed of downloading articles from the internet at the universities

N=37	**F**	**%**	**Cumulative F**	**Cumulative %**
Very slow	-	-	-	-
Slow	3	8.11	3	8.11
Medium	11	29.73	14	37.84
Fast	17	45.95	31	83.79
Very fast	6	16.22	37	100.00

5.4.18 Factors that influence non-use of e-resources by information specialists

Table 5.28 below presents the findings on perceptions of information specialists on the factors that influence non-use of resources by information specialists (Question 19, Appendix 2). Although respondents were expected to respond to all options, often they did not. Therefore N differs and is indicated in the table per option.

Table 5.28 Factors that influence non-use of e-resources

Factors influencing non-use of e-resources	*N*	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
		F	%	F	%	F	%	F	%	F	%
Poor quality of internet connection that slows down speed	36	6	16.67	10	27.78	3	8.33	11	30.56	6	16.67
Lack of access to computers	37	12	32.43	12	32.43	-	-	10	27.03	3	8.11
Login or password to Research4Life programmes	36	6	16.67	12	33.33	2	5.56	14	38.89	2	5.56
Unavailability of full-text articles	38	6	15.79	6	15.79	3	7.89	14	36.84	9	23.68
Too many steps required before getting a full-text article	37	6	16.22	10	27.03	3	8.11	13	35.14	5	13.51
Lack of skills to use the e-resources	37	12	32.43	13	35.14	-	-	8	21.62	4	10.81
Lack of technical support to solve access problems with available e-resources	37	8	21.62	12	32.43	1	2.70	13	35.14	3	8.11
Language of publications, i.e. mostly English	36	14	38.89	15	41.67	3	8.33	3	8.33	1	2.78
Difficulty in finding relevant information	37	7	18.92	13	35.14	6	16.22	8	21.62	3	8.11
High cost of internet access	36	7	19.44	15	41.67	4	11.11	9	25	1	2.78
Lack of time to search e-resources	36	10	27.78	13	36.11	5	13.89	8	22.22	-	-

5.4.18.1 Poor quality of internet connection

Interestestingly, almost a third of the respondents (10/36, 27.78%) *disagreed* that poor quality of internet slows down speed influences the non-use of e-resources. Almost a third of the respondents (11/36, 30.56%) *agreed* with the statement, while six of the 36 (16.67%) *strongly agreed* that a poor quality internet connection slows down speed and influences non-use of e-resources.

5.4.18.2 Lack of access to computers

Another factor cited was lack of access to computers, which led to non-use of e-resources. A third of the respondents (12/37, 32.43%) *strongly disagreed*, while 12 of 37 (32.43%) *disagreed* that this was the case. Ten of 37 (27.03%) *agreed* and only three of 37 respondents (8.11%) *strongly agreed* with the sentiment.

5.4.18.3 Login or password to Research4Life programmes

More than a third of the respondents (14/36, 38.89%) reported that they *agreed* with the sentiment and two of the 36 respondents (5.56%) *strongly agreed* that login or password restrictions on Research4Life programmes (AGORA, HINARI, OARE, ARDI) hindered access to e-resources. Twelve of the 36 (33.33%) *disagreed* with the notion, with 6/36 (16.67%) *strongly disagreeing*.

5.4.18.4 Unavailability of full-text articles

About a third of the respondents (14/38, 36.84%) *agreed* and about a quarter (9/38, 23.68%) *strongly agreed* that the unavailability of full-text articles led to non-use of e-resources by information specialists. In combination, 23/38 (60.52%) *agreed* or *strongly agreed.*

5.4.18.5 Too many steps required before getting a full-text article

Another factor cited as causing the non-use of e-resources is that online too many steps are required before getting a full-text article. More than a third of the respondents (13/37, 35.14%) *agreed* with the notion, and 5/37 (13.51%) *strongly agreed*, while 10 of the 37 respondents (27.03%) *disagreed.* In combination, 16/37 (43.24%) *disagreed or strongly disagreed*, and 18/37 (23.67%) *agreed or strongly agreed.*

5.4.18.6 Lack of skills

Regarding the perception of information specialists on lack of skills hindering the use of e-resources, more than a third (13/37, 35.14%) of respondents *disagreed*, while eight of the 37 (21.62%) *agreed* and four of the 37 (10.81%) *strongly agreed* with the sentiment.

5.4.18.7 Lack of technical support

About a third (13/37, 35.14%) of respondents *agreed* and only three of the 37 (8.11%) *strongly agreed* that lack of technical support to solve access problems with available e-resources led to the non-use of e-resources by information specialists. In combination, 43.25% agreed or strongly agreed with the notion.

5.4.18.8 Language of publications

The perception of information specialists of the language of publications, i.e. mostly English, leading to the non-use of e-resources, was investigated. Fifteen of the 36 respondents (41.67%) *disagreed*, while only 14 (38.89%) *strongly disagreed* that the language of publications led to non-use of e-resources.

5.4.18.9 Difficulty in finding relevant information

Another factor cited as leading to the non-use of e-resources was difficulty in finding relevant information. Eight of the 37 (21.62%) respondents *agreed* and only three out of 37 respondents (8.11%) *strongly agreed* that difficulty in finding relevant information led to non-use of resources. However, more than a third of the respondents (13/37, 35.14%) *disagreed* with the notion. A further 7/37 (18.92%) strongly disagreed.

5.4.18.10 High cost of internet access

Over a third of the respondents (15/36, 41.67%) *disagreed* and 7/36 (19.44%) *strongly disagreed* that the high cost of internet access was an important factor influencing their non-use of e-resources. A quarter of the respondents (9/36, 25%) *agreed* with the notion, while (3/37, 8.11%) *strongly agreed*.

5.4.18.11 Lack of time to search e-resources

Only eight (22.22%) of the respondents out of 36 agreed that lack of time was an important factor influencing their non-use of e-resources. About a third of the respondents (13/36, 36.11%) *disagreed*, while five (13.89%) *neither agreed* nor *disagreed.*

5.4.19 Factors that influence use of e-resources by information specialists

Table 5.29 shows findings on the investigation into information specialists' perception of the factors that influence use of e-resources (Question 20, Appendix 2).

Although respondents were expected to respond to all options, often they did not. Therefore N differs and is indicated in the table per option.

5.4.19.1 High quality of internet access

More than a third of the respondents (14/36, 38.89%) *agreed* and almost half (17/36, 47.22%) of information specialists' respondents *strongly agreed* that high quality internet access allowed better use of e-resources. In combination, 86.11% *agreed* or *strongly agreed* with the sentiment.

5.4.19.2 Ease of use of e-resources

Almost half of the respondents (17/37, 45.95%) *strongly agreed* that ease of use of e-resources, e.g. user-friendly interfaces, influences the use of e-resources by information specialists, while 16 of the 37 (43.24 %) indicated that they *agreed* with this perception. In combination, 89.19% *agreed* or *strongly agreed*.

5.4.19.3 Availability of full-text articles

Information specialists were positive that the availability of full-text articles influenced the use of e-resources. Sixteen (43.24%) of the 37 respondents *agreed* and another 16/37 (43.24%) *strongly agreed* with the sentiment – in combination 86.48%.

5.4.19.4 Good searching skills of information specialists

Good searching skills were cited as a factor enabling use of e-resources and in investigating information specialists' perception of the factor, more than half (21/37, 56.76%) of the respondents a*greed* with the sentiment, while more than a third (15/37, 40.54%) *strongly agreed* – in combination 97.3%.

5.4.19.5 Training of information specialists on e-resources

Information specialists' perception was also ascertained on the influence of training on use of e-resources. Almost half (18/37, 48.65%) of the respondents *agreed*, while 17 of the 37 (45.95%) *strongly agreed* that training influenced the use of e-resources by information specialists. In combination, 94.15% *agreed* or *strongly agreed* with it.

5.4.19.6 Experience in using e-resources

On exploring the perceptions of information specialists on whether experience in using e-resources is an important factor in enabling use of e-resources, half (18/36, 50%) of information specialists *strongly agreed*, while 15 of the 36 respondents (41.67 %) *agreed* with the notion.

Table 5.29 Factors that influence use of e-resources

Factors influencing use of resources	*N*	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
		F	%	F	%	F	%	F	%	F	%
High quality of internet access providing a fast connection	36	2	5.56	2	5.56	1	2.78	14	38.89	17	47.22
Ease of use of e-resources e.g. user-friendly interfaces	37	2	5.41	-	-	2	5.41	16	43.24	17	45.95
Availability of full-text articles	37	1	2.70	1	2.70	3	8.11	16	43.24	16	43.24
Good search skills	37	1	2.70	-	-	-	-	21	56.76	15	40.54
Training on use of e-resources	37	1	2.70	1	2.70	-	-	18	48.65	17	45.95
Experience in using e-resources	36	1	2.78	-	-	2	5.56	15	41.67	18	50
Good technical support when one encounters problems with the e-resources	38	2	5.26	2	5.26	3	7.89	18	47.37	13	34.21
Increase in quality research output required by the university	36	1	2.78	4	11.11	4	11.11	14	38.89	13	36.11
Low cost of internet access	37	3	8.11	3	8.11	3	8.11	17	45.95	11	29.73

5.4.19.7 Good technical support

On exploring the influence of the need of good technical support when encountering problems with the e-resources, almost half of the respondents (18/38, 47.37%) *agreed* and 13/38 (34.12%) *strongly agreed* that good technical support was important when encountering problems with e-resources. In combination, 81.58% *agreed* or *strongly agreed*. Only two of the 38 respondents (5.26%) *strongly disagreed*.

5.4.19.8 Increase in quality research output

A majority of information specialists were positive that an increase in quality research output required by the university influenced the use of e-resources. More than a third of the respondents (14/36, 38.89%) *agreed*, while (13/36, 36.11%) *strongly agreed* with the sentiment – in combination, 75%.

5.4.19.9 Low cost of internet access

About half of the respondents (17/37, 45.95%) to the option indicated that they *agreed* that low cost of internet access led to use of e-resources, while (11/37, 29.73%) *strongly agreed* with the statement – in combination, 75.68%.

5.4.20 E-resources meeting users' needs: perspective of information specialists

Asked to indicate how the e-resources in the respective libraries met the needs of the information specialists (Question 21, Appendix 2), the respondents reported the results presented in Table 5.30 below.

Although respondents were expected to respond to all options, often they did not. Therefore N differs and is indicated in the table per option.

Table 5.30 E-resources meeting needs of users in university libraries

E-resources meeting users' needs	*N*	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
		F	%	F	%	No	%	No	%	No	%
Type of materials covered	38	-	-	3	7.89	3	7.89	18	47.37	14	36.84
Scope of topics covered	38	-	-	-	-	4	10.53	19	50	15	39.47
Currency of materials (e.g. resources are up to date)	38	-	-	1	2.63	-	-	19	50	18	47.37
Availability of full text	38	-	-	3	7.89	6	15.79	17	44.74	12	31.58
Adequate organisation of resources	37	-	-	2	5.41	3	8.11	22	59.46	10	27.03
Relevance of resources to one's research field or fields in which one supports users	38	1	2.63	1	2.63	4	10.53	16	42.11	16	42.11
Ease of access to resources	38	1	2.63	-	-	2	5.26	17	44.74	18	47.37

5.4.20.1 Type of materials covered

Respondents were positive about the type of materials covered in the libraries meeting their users' needs. About half of the respondents (18/38, 47.37%) *agreed* that the type of materials covered by e-resources in their libraries met their needs. 14/38 (36.84%) *strongly agreed*, while only (3/38, 7.89%) *disagreed* with the notion.

5.4.20.2 Scope of topics covered

On being asked whether the scope of topics covered by e-resources met their needs, half of the respondents (19/38, 50%) *agreed* and 15 of the 38 (39.47%) *strongly agreed*. Only four (10.53%) *neither agreed nor disagreed* with the sentiment.

5.4.20.3 Currency of materials

Half of the respondents (19/38, 50%) investigated *agreed* that the currency of materials (e.g. resources) were up to date and met their needs, and (18/38, 47.37%) strongly *agreed* with the sentiment. Only one (2.63%) *disagreed*.

5.4.20.4 Availability of full text of e-resources

In investigating the perception of information specialists on the availability of the full text of e-resources, it was found that almost half (17/38, 44.74%) of information specialists *agreed* that the available full-text e-resources met their needs. Twelve of the 38 (31.58%) *strongly agreed* while only three (7.89%) *disagreed.*

5.4.20.5 Organisation of library resources

More than half (22/37, 59.46%) of the respondents *agreed* that the organisation of library resources was adequate and met their needs. Ten out of 37 (27.03%) *strongly agreed* with the sentiment. Only two (5.41%) *disagreed* with the notion.

5.4.20.6 Relevance of resources to research field

On investigating the relevance of resources to the research field or fields in which information specialists supported users, almost half (16/38, 42.11%) of information specialists *strongly agreed and* 16/38 (42.11%*) agreed* that the relevance levels of the materials met their needs. Only one (2.63%) information specialist respondent *strongly disagreed*.

5.4.20.7 Ease of access to e-resources

On ease of access to resources, almost half (18/38, 47.37%) of information specialists surveyed *strongly agreed* that they had easy access to e-resources and 17/38 (44.74%) agreed. Only one (2.63%) *strongly disagreed* with the sentiment.

5.4.21 Information specialists' training in use of e-resources

When asked what training information specialists had received in the use of the e-resources that their libraries provided, the results are presented in Table 5.31 (Question 22, Appendix 2). *N* differ per option as indicated in the table.

About half of the respondents (17/31, 54.84%) reported that they had received in-house training for all e-resources provided by their library, while a majority indicated that they had either received in-house training for some e-resources (33/35, 94.29%) or self-trained for some e-resources (32/33, 96.97%). About two thirds of them (24/36, 66.67%) indicated that they had been trained by third parties (e.g. attended workshops) on e-resources.

Table 5.31 Information specialists' training in use of e-resources

Training in use of e-resources	***N***	**Yes**		**No**	
		F	%	F	%
No training received	26	2	7.69	24	92.31
Self-training for all e-resources	33	16	48.48	17	51.52
Self-training for some e-resources	33	32	96.97	1	3.03
In-house training for some e-resources	35	33	94.29	2	5.71
In-house training for all e-resources	31	17	54.84	14	45.16
Service provider training for some e-resources	32	19	59.38	13	40.63
Training by third parties (e.g. workshops)	36	24	66.67	12	33.33

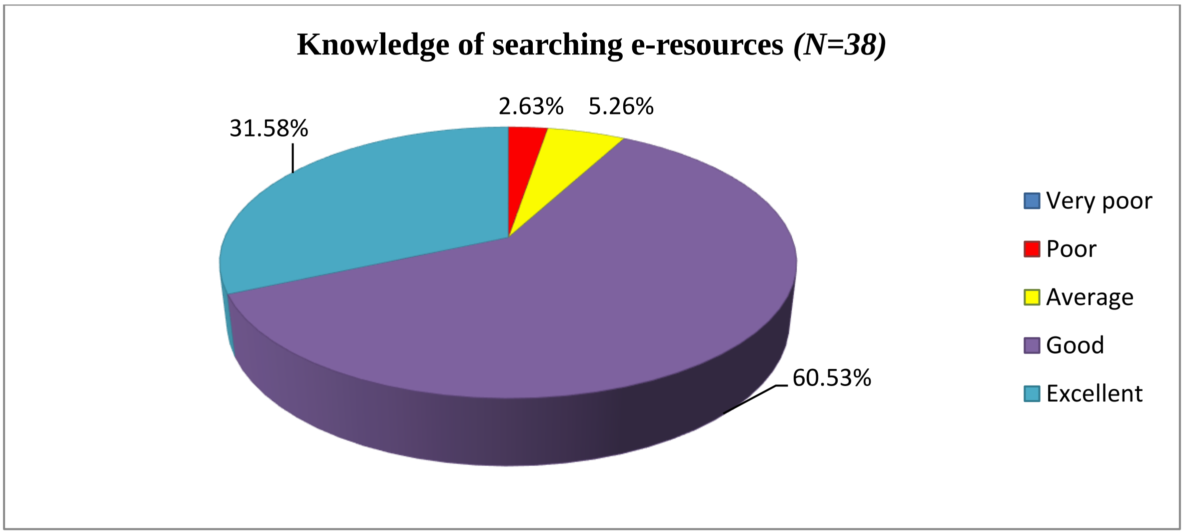
5.4.22 Knowledge of searching e-resources in libraries by information specialists

Figure 5.23 below displays results of how information specialists' rated their knowledge of searching the e-resources provided by their respective libraries (Question 23, Appendix 2). Thirty-eight responded to the question.

The majority of information specialist respondents (23/38, 60.53%) reported good knowledge of searching e-resources, while 12 of the 38 respondents (31.58%) recorded excellent skills and knowledge of searching e-resources.

Only two out of 38 of the respondents (5.26%) thought that they had average knowledge and one (2.63%) had poor knowledge.

Figure 5.23 Knowledge of searching e-resources in respective libraries

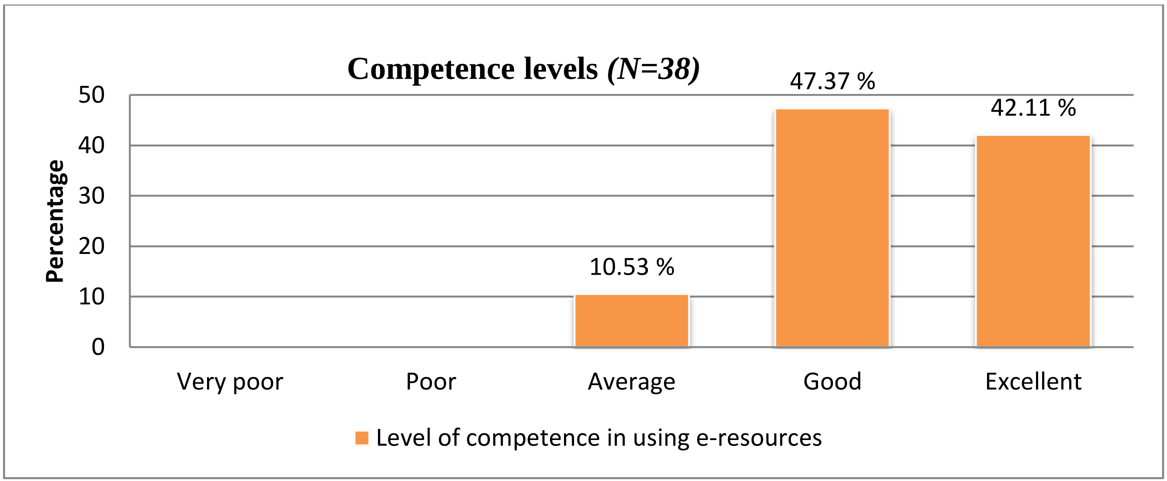


5.4.23 Level of competence in using e-resources by information specialists

Figure 5.24 below represents how the information specialists rated their level of competence in using e-resources (Question 24, Appendix 2). Thirty-eight of the information specialists responded to this question.

A majority of information specialist respondents were competent in using e-resources, with 16 of 38 (42.11%) indicating that they had excellent skills in using e-resources, while 18 of the 38 (47.37%) reported good competence and four (10.53%) said they had average skills. None of the respondents indicated poor or very poor skills.

Figure 5.24 Level of competence in using e-resources

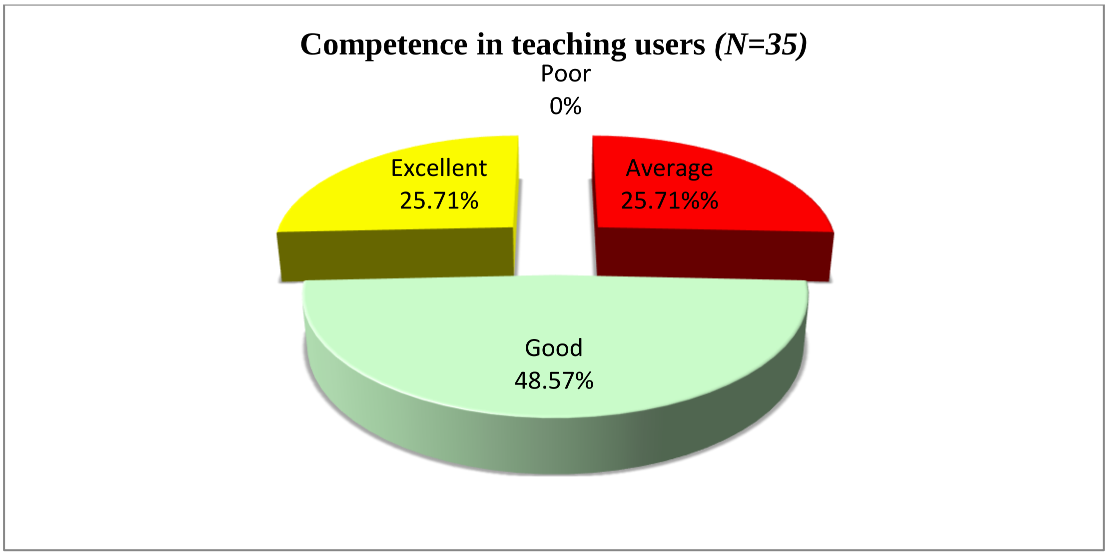


5.4.24 Levels of information specialists' competence in teaching users on e-resources

When the information specialists were asked to rate themselves on their level of competence in teaching users to find relevant information through the e-resources their libraries provided, (Question 25, Appendix 2) they were positive overall. Their responses are presented in Figure 5.25.

The figure reflects that the majority of information specialists considered themselves competent enough in teaching users to find information through e-resources. This is shown with a quarter of the respondents (9/35, 25.71%) reporting average competence, and almost half (17/35, 48.57%) reporting good competence. Another quarter of the information specialists (9/35, 25.71%) reported excellent competence in the same.

Figure 5.25 Levels of competence in teaching users on e-resources



5.5 FINDINGS FROM ACADEMIC STAFF TEACHING IN SCIENTIFIC TECHNOLOGICAL AND MEDICAL DISCIPLINES

This section presents the findings from academic staff teaching in scientific technological and medical disciplines (See Appendix 3: Questionnaire for academic staff teaching in STM disciplines). Of the 150 academic staff approached, 80 returned filled-in questionnaires. The figures and tables explain data on participant's profiles, how they access the internet and use the available library e-resources, and the factors that influence the use and non-use of the e-resources, the training they have received on e-resources and their competence in the use of the e-resources. Tables and figures have been presented on some data sets to clarify the data analysis results (where this was not necessary, only the figure or table is presented). The applicable question numbers are referenced in each of the following sections.

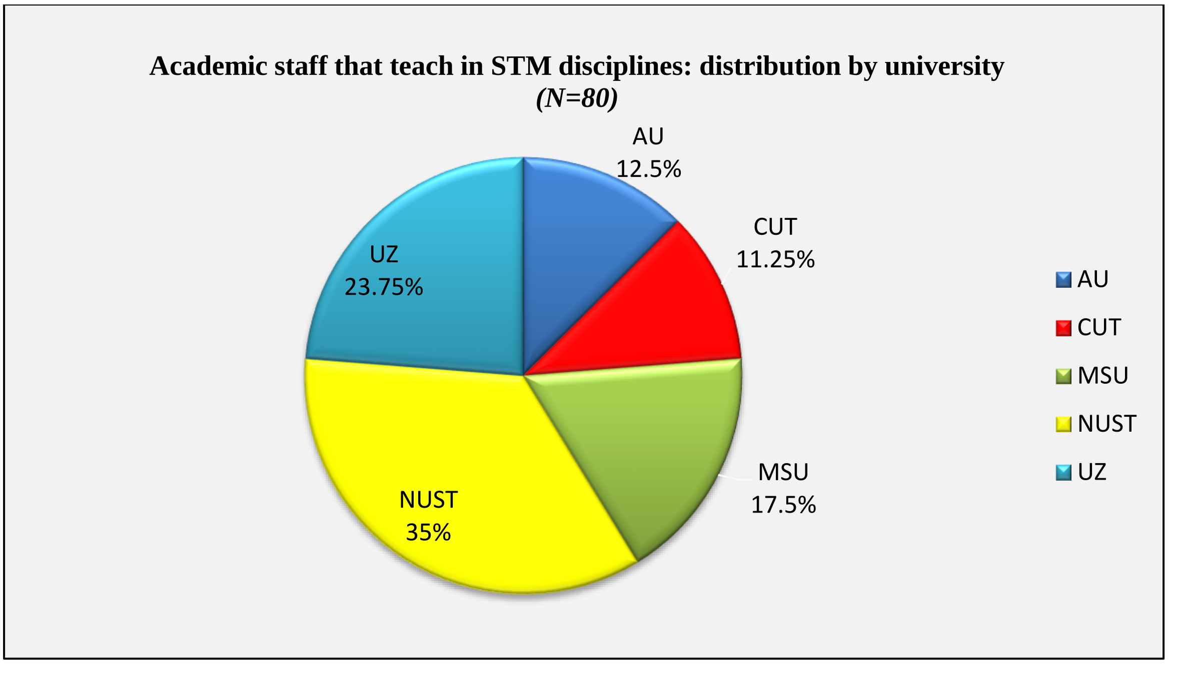
5.5.1 Academic staff that taught in STM disciplines: distribution by university

Respondents were drawn from five universities in Zimbabwe offering STM postgraduate degrees (Question 1, Appendix 3). Table 5.32 below shows the distribution of the respondents by university. National University of Science and Technology (NUST) yielded the largest number of respondents (28/80, 35%), while the smallest number (9/80, 11.25%) of respondents came from Chinhoyi University of Technology (CUT).

Table 5.32 Academic staff respondents' distribution by university

Institution ***N=80***	**F**	**%**	**Cumulative F**	**Cumulative %**
AU	10	12.50	10	12.50
CUT	9	11.25	19	23.75
MSU	14	17.50	33	41.25
NUST	28	35.00	61	76.25
UZ	19	23.75	80	100.00

Figure 5.26 Academic staff respondents' distribution by university



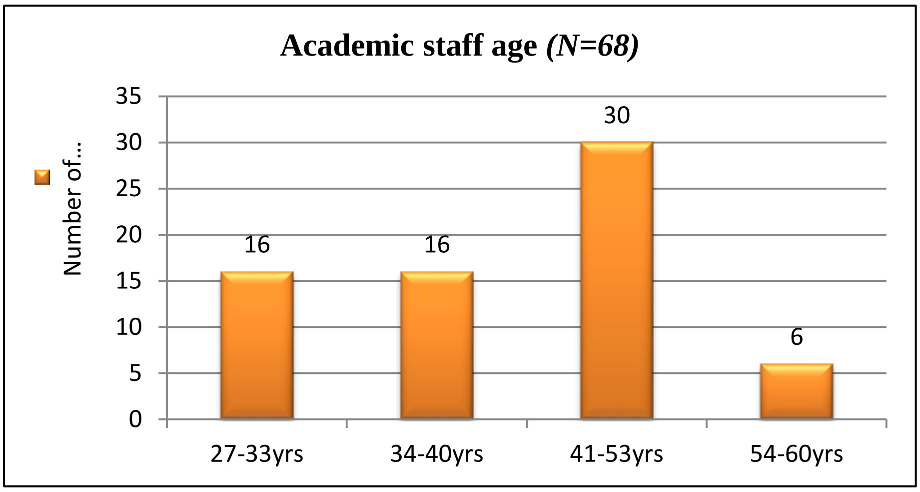
5.5.2 Respondent's distribution by age of academic staff

The descriptive statistics for age are shown in Table 5.33 and Figure 5.27 (Question 2, Appendix 3). The ages of academic staff ranged from a minimum of 27 years to a maximum of 60 years, which is a range of 33 years. The mean age was 41.28 years, with a standard deviation of 8.29.

Table 5.33 Academic staff respondents' distribution by age *(N=68)*

N=68	
Mean	41.28
Lower Quartile	34
Median	41
Upper Quartile	47.50
Std Dev	8.29
Minimum	27
Maximum	60

Figure 5.27 Academic staff: distribution by age



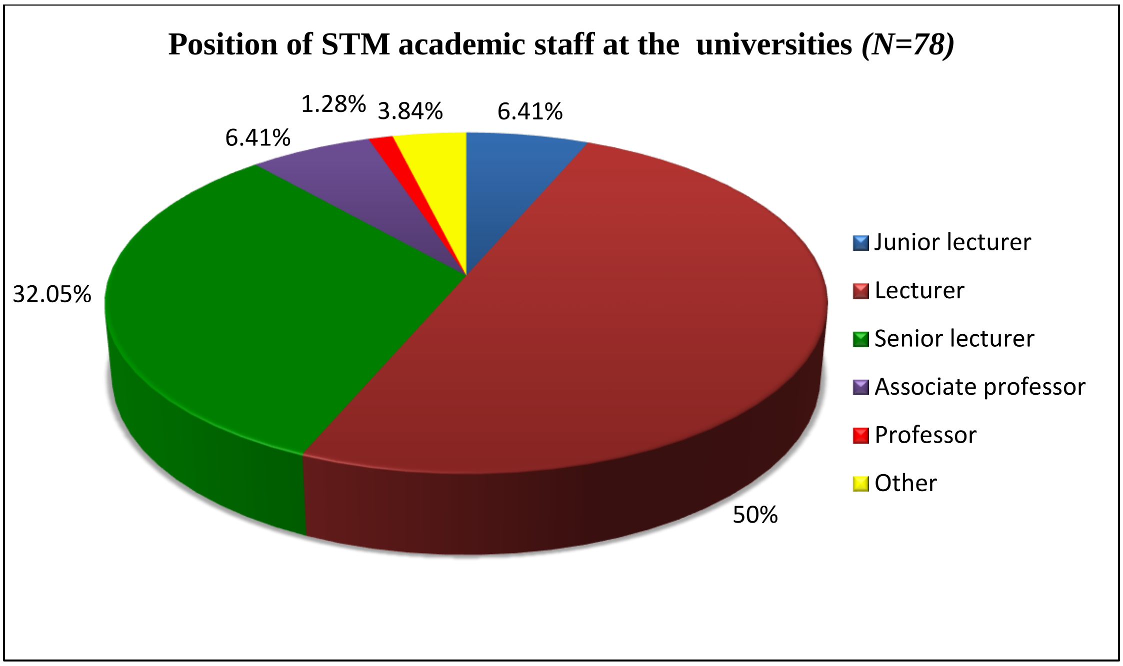
5.5.3 Distribution of academic staff respondents

Table 5.34 and Figure 5.28 below show the responding academic staff's distribution (Question 3, Appendix 3). The majority of the academic staff held the position of lecturer (39/78, 50%), followed by senior lecturer (25/78, 32.05%). Five academic staff members (6.41%) held associate professor positions, while only one academic staff member (1.28%) was a professor. The three respondents who selected *other* were an intellectual property officer, dean and visiting adjunct professor (visiting professor).

Table 5.34 Academic staff in STM disciplines: distribution by position

N=78	**F**	**%**	**Cumulative F**	**Cumulative %**
Junior lecturer	5	6.41	5	6.41
Lecturer	39	50.00	44	56.41
Senior lecturer	25	32.05	69	88.46
Associate professor	5	6.41	74	94.87
Professor	1	1.28	75	96.15
Other: intellectual property	1	1.28	76	97.44
Other: dean	1	1.28	77	98.72
Other: visiting adjunct professor	1	1.28	78	100

Figure 5.28 Position of academic staff teaching in STM disciplines



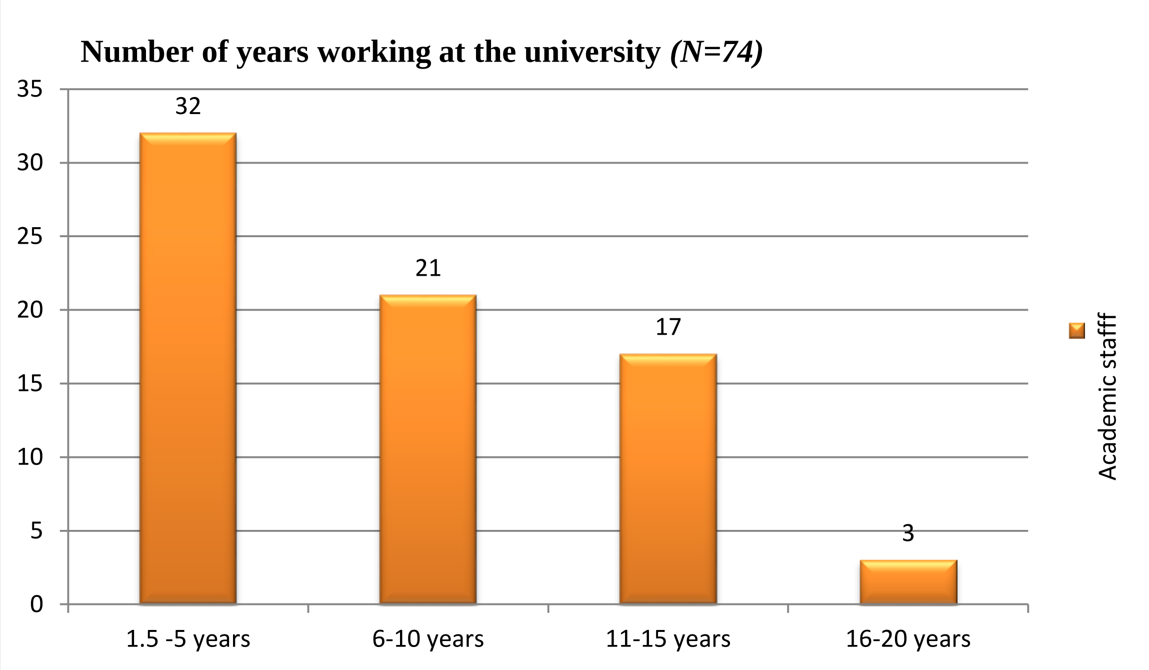
5.5.4 Academic staff's years of teaching experience

The descriptive statistics for staff's teaching experience are shown in Table 5.35 and Figure 5.29 (Question 4, Appendix 3). The academic staff members' years of experience at their respective universities ranged from a minimum of 1.5 years to a maximum of 20 years, which is a range of 18.5 years. The mean age was 7.53 years, with a standard deviation of 4.24.

Table 5.35 Respondent distribution by years of experience

N=73	
Mean	7.53
Lower Quartile	4
Median	6
Upper Quartile	11
Std Dev	4.24
Minimum	1.5
Maximum	20

Figure 5.29 Respondents' distribution by years of experience at the university



5.5.5 Academic staff's experience at other institutions

Table 5.36 below shows that academic staff members' years of experience at other institutions prior to joining their respective institutions ranged from a minimum of one year to a maximum of 18 years (Question 5, Appendix 3). The majority of the academic staff respondents had two years' experience (8/32, 25%), followed by those with four years' experience (7/32, 21.88%). The longest experience indicated was a single academic staff member with 18 years' experience at other institutions (1/32, 3.33%). Only the years mentioned are indicated in Table 5.36 – thus the years are not sequential.

Table 5.36 Academic staff distribution by years of experience at another institution

Academic staff years of experience *(N=32)*	**F**	**%**	**Cumulative F**	**Cumulative %**
1	1	3.13	1	3.13
2	8	25.00	9	28.13
3	6	18.75	15	46.88
4	7	21.88	22	68.75
5	2	6.25	24	75
6	1	3.13	25	78.13
7	1	3.13	26	81.25
8	1	3.13	27	84.38
10	2	6.25	29	90.63
11	1	3.13	30	93.75
15	1	3.13	31	96.88
18	1	3.13	32	100

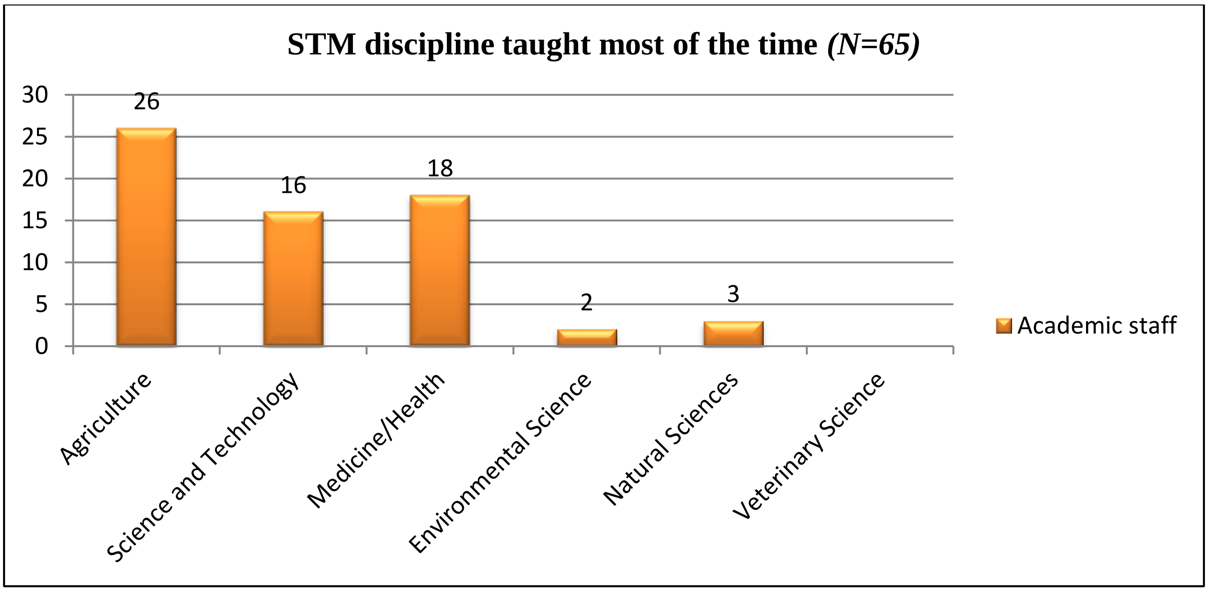
5.5.6 Academic staff: disciplines taught most of the time

The descriptive statistics for teaching disciplines taught most often by the respondents are shown in Table 5.37 and Figure 5.30 (Question 6, Appendix 3). The majority of the academic staff taught agriculture (26/65, 40%), followed by the medicine or health discipline (18/65, 27.69%). Only (3/65, 4.62%) indicated that they taught natural sciences and (2/65, 3.08%) taught environmental sciences.

Table 5.37 Academic staff respondents: distribution by disciplines taught

Academic staff teaching disciplines *(N=65)*	**F**	**%**	**Cumulative F**	**Cumulative %**
Agriculture	26	40	26	40
Science and Technology	16	24.62	42	64.62
Medicine/Health	18	27.69	60	92.31
Environmental Science	2	3.08	62	95.38
Natural Sciences	3	4.62	65	100
Veterinary Sciences	0	0	0	

Figure 5.30 STM disciplines taught most of the time



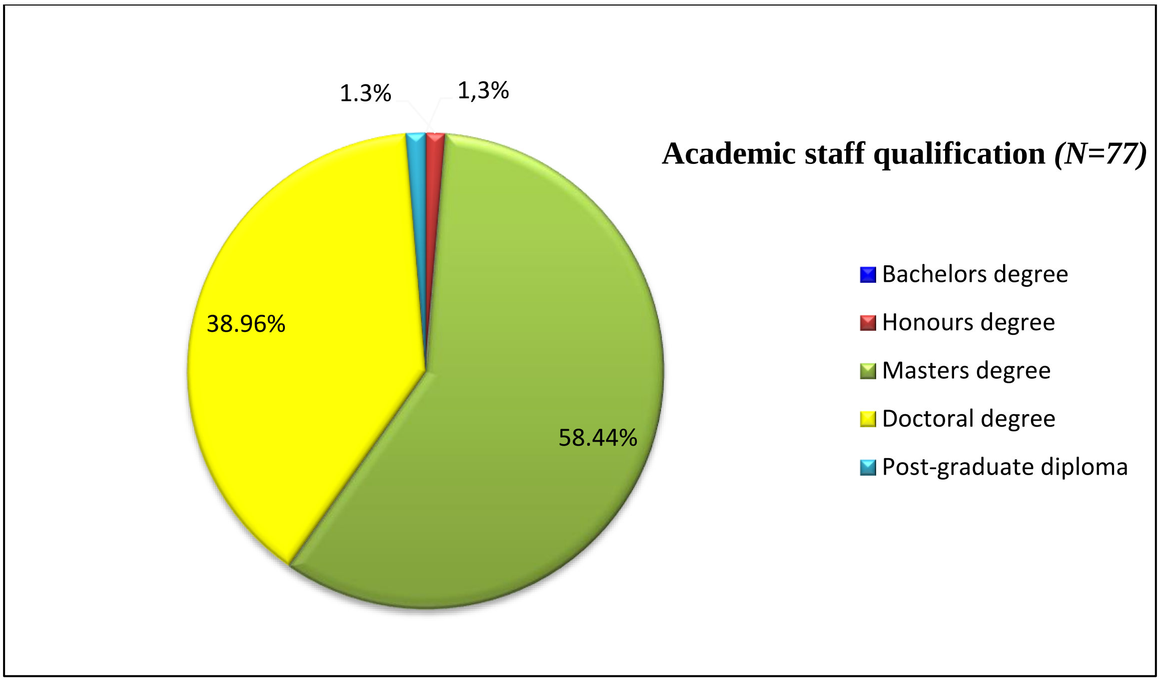
5.5.7 STM academic staff: highest qualification

Table 5.38 and Figure 5.31 below show the distribution of the highest qualification of the academic staff respondents (Question 7, Appendix 3). The majority of the academic staff respondents had a master's degree (45/77, 58.44%), followed by those with a doctorate (30/77, 38.96%). Only one of the respondents had a postgraduate diploma.

Table 5.38 Academic staff highest qualification

Academic staff *(N=77)*	F	%	Cumulative F	Cumulative %
Bachelor's degree	0	0	0	0
Honours degree	1	1.30	1	1.30
Master's degree	45	58.44	46	59.74
Doctorate	30	38.96	76	98.70
Postgraduate diploma	1	1.30	77	100

Figure 5.31 Academic staff: highest qualification



5.5.8 STM academic staff duties

When academic staff were asked to indicate what duties they were involved in and to indicate the percentage of time spent on each per year (Question 8, Appendix 3), results showed that teaching or lecturing occupied a mean of 51.6% of the time of the academic staff respondents per year. The reported time allocation ranged from 10% to 90%, giving a range of 80% with a standard deviation of 18.14%.

Research (including publications and presentations) occupied a mean of 25.89% of the time of academic staff per year. The reported time allocation for this duty ranged from 2% to 90%, giving a range of 88% with a standard deviation of 14.75%.

Supervision of master's and/or doctoral students' research and administration and other duties were reported to have lower allocations (Table 5.39).

Table 5.39 Academic staff duties

Academic staff duties	*N*	Mean	Lower quartile	Median	Upper quartile	Std Dev	Min.	Max.
Teaching or lecturing	75	51.6	30	50	70	18.14	10	90
Research (including publications and presentation)	74	25.89	20	20	30	14.75	2	90
Supervision of master's and/or doctoral students' research	62	15.18	10	10	20	10.25	-	70
Administration and other	49	12.76	5	10	15	11.16	-	60
Other (please specify)	17	9.06	5	10	10	6.72	-	24

5.5.9 Publication of research papers and book chapters by STM academic staff

Table 5.40 below shows the distribution of research papers, books and book chapters published by STM academic staff at the universities in the 24 months preceding data collection (Question 9, Appendix 3). The majority of the academic staff published journal articles (64/80, 80%), followed by conference publications (50/80, 62.50%).

5.5.9.1 Scholarly journals

Sixty-four of the academic staff respondents indicated that they had published research papers in scholalrly journals over the 24 months preceding data collection. The number of research papers ranged from a minimum of one paper to a maximum of 30 papers. The figure of 30 research papers recorded by one of the academic staff indicated that there was some discrepancy in the record.

The mean was 5.73 articles, with a standard deviation of 6.4.

5.5.9.2 Book chapters

Twenty-eight of the academic staff respondents indicated that they had published a book chapter over the 24-months preceding data collection. The number of chapters ranged from a minimum of zero book chapters to a maximum of six. The mean was 1.68 articles with a standard deviation of 1.66.

5.5.9.3 Books

Seventeen academic staff members reported publishing books during the period. The maximum number of books per author was two.

5.5.9.4 Patents

Thirteen academic staff members indicated that they had registered patents. The maximum number of books per author was two.

5.5.9.5 Conferences

Fifty academic staff members published papers at conferences during the 24-month period preceding data collection. The number of presentations reached a maximum of 27 per person presentations over the period.

Table 5.40 Papers published by academic staff

Publications by academic staff	ScholarlyJournals	Book chapters	Books	Patents	Conferences
N =80	64	28	17	13	50
Mean	5.73	1.68	0.47	0.15	4.96
Lower quartile	2	1	0	0	2
Median	4	1	0	0	3
Upper quartile	7	2.5	1	0	6
Std dev	6.4	1.66	0.8	0.55	5.5
Minimum	1	0	0	0	0
Maximum	30*	6	2	2	27

*Figure checked and is what the participant reported

5.5.10 Ways in which STM academic staff accessed the internet

The results of a question on how the STM academic staff accessed the internet are presented in Table 5.41, below (Question 10, Appendix 3). Although respondents were expected to respond to all options, often they did not. N differs for each option as indicated in the table.

The results show that the majority of the respondents indicated that they had an *internet connection at work and one at home* (58/70, 82.86%) followed by academic staff with *internet connection at work only* (22/44, 50%) and those who used *internet cafés* (15/36, 41.67%).

Interestingly, a significant minority of the academic staff respondents (7/36, 19.44%) indicated that they did not access the internet (Table 5.41).

Table 5.41 Ways in which academic staff accessed the internet

Ways in which academic staff accessed the internet	***N***	**Yes**		**No**	
		F	%	F	%
Do not access the internet	36	7	19.44	29	80.56
Internet connection at home only	37	4	10.81	33	89.19
Internet connection at work only	44	22	50	22	50
Internet connection at work and home	70	58	82.86	12	17.14
Internet café	36	15	41.67	21	58.33

5.5.11 Type of device used by STM academic staff to access the internet

It was asked which type of device academic staff used to access the internet (Question 11, Appendix 3). There were 80 responses to this question and they could select more than one option. The results presented in Table 5.42 below show that the majority of academic staff cited using a laptop (77/80, 96.25%) followed by a mobile phone (48/80, 6%) and then a desktop computer (41/80, 51.25%). The tablet (e.g. iPad, Galaxy) was the least used device (23/80, 28.75%).

5.5.11.1 Desktop computer

Forty-one academic staff indicated that they used a desktop computer to access the internet. The level of use of the device ranged from 3% to 100%. The mean was 37.34% with a standard deviation of 25.30%.

5.5.11.2 Laptop computer

Seventy-seven academic staff indicated that they used a laptop computer to access the internet. The level of use of the device ranged from 10% to 100%. The mean was 66.60% with a standard deviation of 26.19%.

5.5.11.3 Tablet

Twenty-three academic staff reported that they used a tablet (e.g. iPad, Galaxy) to access the internet. The level of use of the device ranged from 2% to 50%. The mean was 14.22% with a standard deviation of 10.72%.

5.5.11.4 Mobile phone

Forty-eight academic staff indicated that they used a mobile phone to access the internet. The level of use of the device ranged from 2% to 50%. The mean was 16.38% with a standard deviation of 11.76%.

Table 5.42 Types of devices used by academic staff to access the internet

Types of devices used by academic staff	Desktop computer	Laptop	Tablet (e.g. iPad, Galaxy)	Mobile phone
N =80	**41**	**77**	**23**	**48**
Mean	37.34	66.60	14.22	16.38
Lower quartile	15	50	5	10
Median	40	70	10	10
Upper quartile	50	90	20	20
Std dev	25.30	26.19	10.72	11.76
Min.	3	10	2	2
Max.	100	100	50	50

5.5.12 Frequency of accessing full-text journal articles by STM academic staff

Academic staff were asked to indicate how they accessed full-text journal articles (Question 12, Appendix 3). The results are displayed in Table 5.43 below. N differs for each option as indicated in the table.

5.5.12.1 Search in the library catalogue

Almost half of the academic staff respondents (35/75, 46.67%) indicated that they searched in the library catalogue to access full-text journal articles *sometimes*, while only 11 of the 75 (14.67) reported that they used this method *almost every time* and two (2.67%) reported that they used it *every time*.

5.5.12.2 Databases (including e-journals and e-books)

Over half of the academic staff searched in databases for full-text articles (53.85%). They searched the databases either *every time* (19/78, 24.36%) or *almost every time* (23/78, 29.49%).

5.5.12.3 Google Scholar

The majority of academic staff (22/78, 28.21%) and (21/78, 26.92%) used Google Scholar to search for full-text journal articles *almost every time* or *every time*, respectively.

5.5.12.4 General search engines

Two-thirds of the academic staff respondents (i.e. 31/75, 41.33% and 17/75, 22.67%) indicated that they used general search engines (e.g. Google, Bing) *almost every time* or *every time*, respectively, to access the full-text journal articles.

Table 5.43 Accessing full-text journal articles by STM academic staff

STM academic staff accessing full-text journal articles	*N*	Never		Almost never		Sometimes		Almost every time		Every time	
		F	%	F	%	F	%	F	%	F	%
Search in the library catalogue	75	14	18.67	13	17.33	35	46.67	11	14.67	2	2.67
Databases (including e-journals and e-books)	78	1	1.28	3	3.85	32	41.03	23	29.49	19	24.36
Google Scholar	78	2	2.56	6	7.69	27	34.62	22	28.21	21	26.92
General search engines (e.g. Google, Bing)	75	1	1.33	3	4.00	23	30.67	31	41.33	17	22.67
Institutional repositories	76	7	9.21	29	38.16	23	30.26	10	13.16	7	9.21
Database for theses and dissertations	76	7	9.21	20	26.32	34	44.74	8	10.53	7	9.21

5.5.12.5 Institutional repositories

Almost half of the respondents had not used institutional repositories to access full-text journal articles; respectively 29 of 76 (38.16%) and seven of 76 had *almost never* or *never* used them.

5.5.12.6 Databases for theses and dissertations

Less than half (34/76, 44.74%) of the respondents said they *sometimes* used a database for theses and dissertations to access full-text journal articles, while 20/76 (26.32%) said that they *almost never* used them. In combination, about a fifth of the respondents (15/76, 19.74%) said they used them every time or almost every time.

5.5.13 Use of e-resources by STM academic staff

Table 5.44 below shows how often the listed e-resources or databases were used by the academic staff in STM disciplines (Question 13, Appendix 3). As indicated in Table 5.44 the number of respondents were not always the same as indicated by N for each option.

OARE and HIGHWIRE were the least reported databases to be used. For HIGHWIRE, 50 of 67 respondents (74.63%) indicated that they had *never* used the database, while for OARE 48 of 62 respondents (77.42%) had *never* used the database.

Table 5.44 Use of databases by STM academic staff

Use of e-resources by academic staff	*N*	Never		Almost never		Once in a while		Often		Very often	
		F	%	F	%	F	%	F	%	F	%
AGORA	70	32	45.71	9	12.86	19	27.14	7	10.0	3	4.29
BioMed Central	68	33	48.53	7	10.29	15	22.06	9	13.24	4	5.88
Cab Abstracts	68	38	55.88	6	8.82	12	17.65	8	11.76	4	5.88
EBSCO Host	68	36	52.94	10	14.71	12	17.65	7	10.29	3	4.41
Emerald	68	38	55.88	9	13.24	12	17.65	6	8.82	3	4.41
HIGHWIRE	67	50	74.63	8	11.94	6	8.96	2	2.99	1	1.49
HINARI	69	27	39.13	7	10.14	14	20.29	13	18.84	8	11.59
JSTOR	69	30	43.48	8	11.59	16	23.19	9	13.04	6	8.7
OARE	62	48	77.42	9	14.52	5	8.06	-	-	-	-
PubMed	67	26	38.81	4	5.97	19	28.36	10	14.93	8	11.94
TEEAL	68	39	57.35	7	10.29	13	19.12	5	7.35	4	5.88

5.5.13.1 AGORA

Only about a quarter of the academic staff teaching in STM disciplines (19/70, 27.14%) indicated that they used AGORA *once in a while.* About half of the respondents reported that they had either *never* used AGORA or *almost never* used it, i.e. 32 of 70 (45.71%) and nine of 70 (12.86%), respectively.

5.5.13.2 Biomed Central

Only 15/68 (22.06%) indicated that they used the resource *once in a while*. The majority reported that they either had *never* used it or *almost never* used it, i.e. 33 of 68 (48.53%) and seven of 68, (10.29%), respectively.

5.5.13.3 CAB Abstracts

Only a minority of the academic respondents used CAB Abstracts either *often* (8/68, 11.76%) or *very often* (4/68, 5.88%). A majority had *never* used it (38/68, 55.88%).

5.5.13.4 EBSCO Host

The majority of the respondents indicated that they had *never* used the resource (36/68, 52.94%), while (10/68, 14.71%) had *almost never* used it. Only seven (10.29%) used it *often* and (3/68, 4.41%) *very often*.

5.4.13.5 Emerald

Only a minority of the academic staff in STM indicated that they *often* (6/68, 8.82%) used Emerald, while three of 68 (4.41%) used the database *very often*. More than two thirds of the academic staff respondents had either *never* used Emerald (38/68, 55.88%) or *almost never* used it (9/68, 13.24%). Only twelve of 68 (17.65%) used Emerald *once in a while.*

5.5.13.6 HIGHWIRE

The majority of the academic staff respondents (50/67, 74.63%) indicated that they had *never* used HIGHWIRE, while (8/67, 11.94%) had *almost never used* it. Only six (8.96%) reported that they had used HIGHWIRE *once in a while*.

5.5.13.7 HINARI

About a fifth (13/69, 18.84%) of academic staff respondents used HINARI *often*, while eight of the 69 (11.59%) used the resource *very often*. About a third of the respondents (27/69, 39.13%) had *never* used HINARI, while seven of 69 (10.14%) had *almost never* used the resource. Only a fifth (14/69, 20.29%) indicated that they had used HINARI *once in a while.*

5.5.13.8 JSTOR

Thirty of 69 (43.48%) academic staff respondents had *never* used JSTOR, while eight of 69 (11.57%) academic staff had *almost never* used it. Only 16 out of 69 (23.19%) of the respondents had used JSTOR *once in a while*.

5.5.13.9 OARE

Almost three quarters (48/62, 77.42%) of academic staff respondents in STM had *never* used OARE, while nine of the 62 (14.52%) of the respondents had *almost never* used the resource. Only five out of 62 (8.06%) of academic staff had used OARE *once in a while*.

5.5.13.10 PubMed

In the study, 19 of 67 (28.36%) of the academic staff respondents reported using PubMed *once in a while*. The majority *never* used or *almost never* used PubMed, i.e. 26 of 67 (38.81%) and four of the 67 (5.97%) respectively. Only a minority *often* used PubMed (10/67, 14.93%), while 8 of 67 (11.94%) used it *very often*.

5.5.13.11 TEEAL

About two thirds (39/68, 57.35%) of academic staff respondents indicated that they had *never* used TEEAL. Only (5/68, 7.35%) of the respondents used it *often* and *very often* (4/68, 5.88%).

5.5.14 Use of e-resources by STM academic staff to perform specific tasks

Table 5.45 below shows academic staff's use of e-resources for specific tasks in their work (Question 14, Appendix 3). Over two thirds of the respondents indicated that they either used e-resources **to prepare for teaching students** *often* (25/77, 32.47%) or *very often* (26/77, 33.77%), while 26 of the 73 (35.62%) academic staff members used e-resources *often* or *very often* (15/73, 20.55%) **to run current awareness/alerting services** for their own benefit.

More than a third of the academic staff respondents (25/73, 34.25%) *often* use e-resources **to verify bibliographic detail,** while 24 out of 73 (32.88%) use e-resources *once in a while* for the same purpose.

The majority of academic staff used e-resources **to prepare articles**, *often* (26/76, 34.21%) or *very often* (34/76, 44.74%), while 28 of the 74 (37.84%) academic staff members *often* or *very often* **(**27/74, 36.49%) used e-resources to **prepare papers for conferences**.

The academic staff also reported that 22 of the 70 (31.43%) respondents *often* used the e-resources **to write grant proposals while another** 13 out of 70 **(**18.57%) *very often* did the same.

Table 5.45 Use of e-resources by STM academic staff

Use of e-resources-by academic staff	***N***	**Never**		**Almost never**		**Once in a while**		**Often**		**Very often**	
		F	%	F	%	F	%	F	%	F	%
To prepare for teaching students	77	5	6.49	2	2.6	19	24.68	25	32.47	26	33.77
To run current awareness/alerting services for their own benefit	73	6	8.22	9	12.33	17	23.29	26	35.62	15	20.55
To verify bibliographic detail	73	5	6.85	5	6.85	24	32.88	25	34.25	14	19.18
To prepare articles	76	7	9.21	3	3.95	6	7.89	26	34.21	34	44.74
To prepare papers for conferences	74	6	8.11	2	2.70	11	14.86	28	37.84	27	36.49
To write grant proposals	70	16	22.86	3	4.29	16	22.86	22	31.43	13	18.57
Other	25	10	40	4	16	7	28	2	8	2	8

5.5.15 Downloading of full text articles by academic staff in STM disciplines

Figure 5.46 presents the results of academic staff downloading full text e-journal articles from the internet (Question 15, Appendix 3). Twenty-six of 63 (41.27%) academic staff members at *least once a day* download a full text article, while 30 of 63 (47.62%) academic staff members download full-text articles several times each day.

Table 5.46 Frequency of downloading full text articles by academic staff

Frequency of downloading full-text articles	***N***	**Never**		**Once**		**Several times**	
		F	%	F	%	F	%
Daily	63	7	11.11	26	41.27	30	47.62
Weekly	62	3	4.84	14	22.58	45	72.58
Monthly	62	2	3.23	7	11.29	53	84.48

Fourteen of 62 (22.58%) academic staff members downloaded full-text articles about once a week, whereas some academic staff members (45/62, 72.58%) downloaded full-text articles *several times per week*. A majority of the academic staff (53/62, 84.48%) indicated that they download full-text articles *several times a month*.

5.5.16 Impression of average speed of downloading articles from the internet by academic staff in STM disciplines

Table 5.47 below presents findings on academic staff's opinions on the speed of downloading articles (Question 16, Appendix 3). The majority of the academic staff (42/79, 53.16%) reported that the downloading speed of articles from the internet was *medium*, while 23/79, (29.11%) indicated that the speed was *quick* with 5/79 (6.33%) reporting *very quick*. Only a minority (3/79, 3.8%) thought that the speed was *very slow* or just *slow* (6/79, 7.59%).

Table 5.47 Speed of downloading articles

Speed of downloading articles ***(N=79)***	**F**	**%**	**Cumulative F**	**Cumulative %**
Very slow	3	3.8	3	3.8
Slow	6	7.59	9	11.39
Medium	42	53.16	51	64.55
Quick	23	29.11	74	93.67
Very quick	5	6.33	79	100

5.5.17 E-journal articles downloaded per year from the internet by academic staff in STM disciplines

Table 5.48 and Figure 5.32 below show the distribution of approximate number of journal articles downloaded by academic staff (Question 17, Appendix 3). Sixty-three responded to the question. The number of articles downloaded ranged from four to 1 500, with a mean of 196.41 articles and a standard deviation of 293.04.

Nine of 63 (14.29%) academic staff had downloaded between four and 20 articles per year, while 17/63 (26.98%) academic staff had downloaded between 21 and 60 articles. On the other end 27/63 (42.86%) downloaded between 80 and 300 articles per year, while 10/63 (15.87%) staff downloaded between 301 and 1 500 articles per year. Table 5.3 below presents the results. Based on the responses the groupings cater for the expanded range from four to1 500 articles.

Figure 5.32 Electronic journal articles downloaded per year

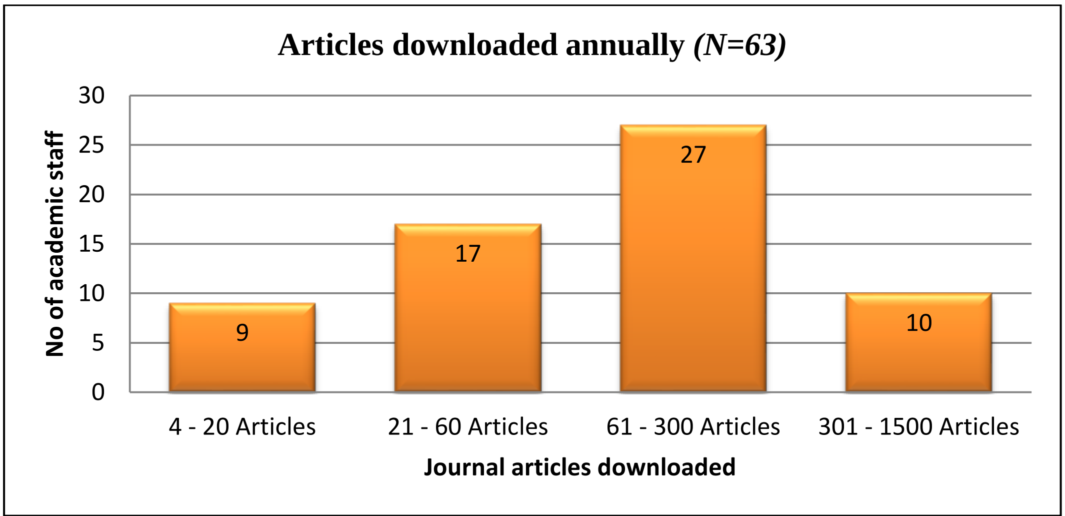


Table 5.48 E-journal articles downloaded per year

Articles downloaded annually *(N-63)*	
Mean	196.41
Lower quartile	40
Median	100
Upper quartile	200
Std dev	293.04
Minimum	4
Maximum	1 500

5.5.18 Print journal articles located per year by academic staff in STM disciplines

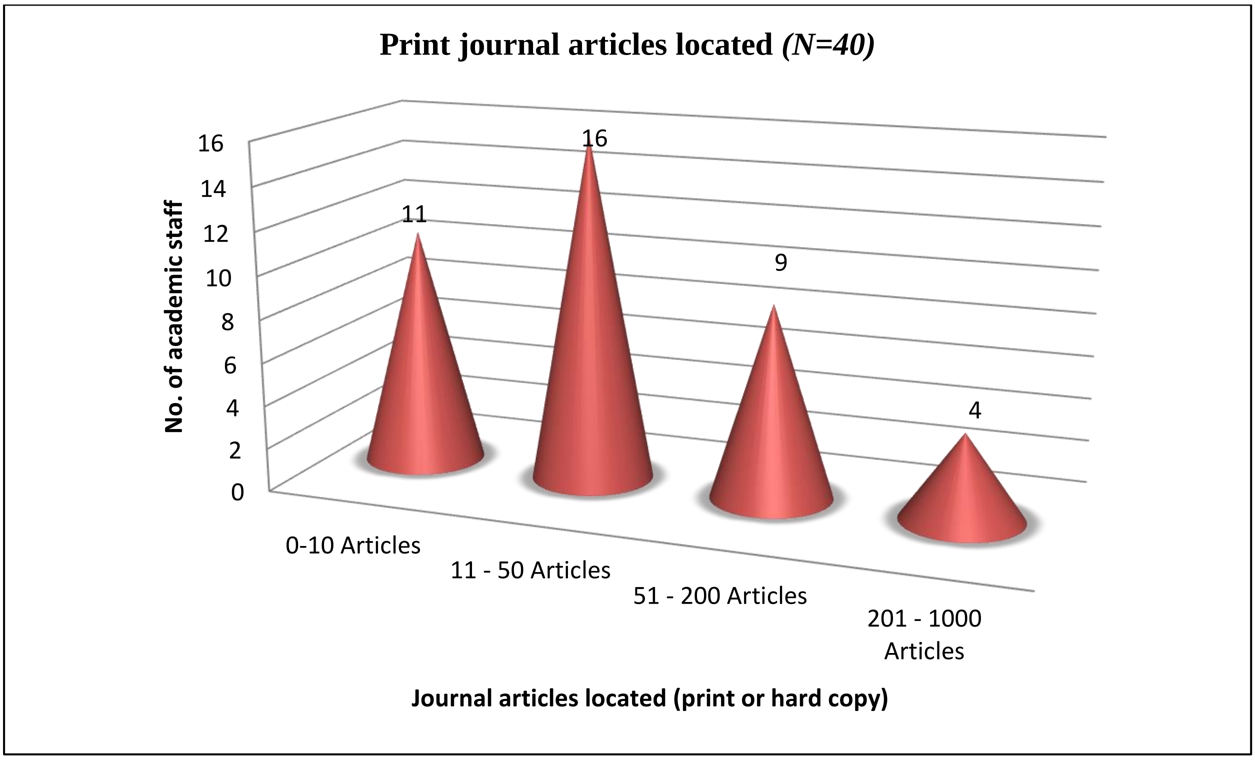
Table 5.49 shows the number of journal articles that academic staff located in print or hard copy per year (Question 18, Appendix 3). The minimum reported was two and the maximum was 1 000, giving a range of 998, a mean of 97.50 and a standard deviation of 182.20.

About a quarter of the respondents (11/40, 27.5%) located zero to 10 articles in print or hard copy, while more than a third of the academic staff (16/40, 40%) located from 11 to 50 articles. On the other end 9/40 (22.5%) located 51 to 200 articles, while 4/40 (10%) located from 201 to 1 000 articles. The four intervals were designed to cover the whole range of responses considering the clusters of data.

Table 5.49 Print or hardcopy journal articles located per year

Located print articles *(N=40)*	
Mean	97.50
Lower quartile	10
Median	35
Upper quartile	100
Std dev	182.20
Minimum	2
Maximum	1000

Figure 5.33 Journal articles located (print or hard copy) by academic staff



5.5.19 Factors that influence non-use of e-resources by academic staff in STM disciplines

When academic staff were asked to indicate factors that influenced their *non-use* of e-resources at the universities they reported the levels presented in Table 5.50, below and explained in the following subsections 5.5.19.1 to 5.5.19.10 (Question 19, Appendix 3). Although respondents were expected to respond to all options, often they did not. Therefore N differs, and is indicated in the table per option.

Table 5.50 Factors that influence non-use of e-resources

Factors influencing non-use of e-resources	***N***	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
Poor quality of internet connection that slows down speed	71	32	45.07	22	30.99	1	1.41	12	16.9	4	5.63
Lack of access to computers	74	14	18.92	19	25.68	3	4.05	33	44.59	5	6.76
Login or password to Research4Life programmes (AGORA, HINARI, OARE)	75	8	10.67	15	20	6	8	35	46.67	11	14.67
Unavailability of full-text articles	73	8	10.96	14	19.18	5	6.85	30	41.1	16	21.92
Too many steps required before getting a full-text article	75	5	6.67	12	16	7	9.33	37	49.33	14	18.67
Lack of skills to use e-resources	72	11	15.28	14	19.44	6	8.33	33	45.83	8	11.11
Lack of technical support to solve access problems with available e-resources	73	18	24.66	19	26.03	11	15.07	19	26.03	6	8.22
Language of publications, i.e. mostly English	74	18	24.32	14	18.92	13	17.57	22	29.73	7	9.46
High cost of internet access	73	34	46.58	28	38.36	4	5.48	7	9.59	-	-
Lack of time to search e-resources	76	17	22.37	27	35.53	6	7.89	20	26.32	6	7.89

5.5.19.1 Poor quality of internet connection that slows down speed

The majority of academic staff indicated that they *disagreed* (22/71, 30.99%) or *strongly disagreed* (32/71, 45.07%) that poor quality of internet connection slows down speed influenced non-use of e-resources.

5.5.19.2 Lack of access to computers

Almost half of the academic staff respondents, (33/74, 44.59%) indicated that they *agreed* that lack of access to computers influenced non-use of e-resources by academic staff – while 19 of 74 (25.68%) disagreed. In combination, 33 of 74 (44.59%) disagreed or strongly disagreed with the notion.

This finding correlates with the study finding that average 66.60% reported that they had access to laptops.

5.5.19.3 Login or password to Research4Life programmes

About half of the respondents (35/75, 46.67%) reported that they *agreed* that login or password to Research4Life programmes (AGORA, HINARI, OARE, ARDI) influenced the use of e-resources, with another 11/75 (14.67%) *strongly agreeing*.

5.5.19.4 Unavailability of full-text articles

Thirty of 73 (41.1%) of the respondents indicated that they *agreed* that unavailability of full-text articles influenced the non-use of e-resources, while (16/73, 21.92%) *strongly agreed* with the sentiment.

5.5.19.5 Too many steps before getting full-text articles

Half of the respondents (37/75, 49.33%) reported that too many steps required before getting a full-text article in e-resources was a factor in non-use of e-resources, while a further 14/75 (18.67%) *strongly agreed*.

5.5.19.6 Lack of skills of academic staff to use e-resources

A majority of the respondents were positive that lack of skills to use e-resources was an important factor in the non-use of e-resources by academic staff (i.e. 33/72, 45.83%, *agreed* and 8/72 (11.11%) *strongly agreed* with the statement).

5.5.19.7 Lack of technical support to solve access problems with available e-resources

Academic staff respondents disagreed with the assession that lack of technical support to solve access problems with available e-resources influenced the use of e-resources. Nineteen of 73 respondents (26.03%) *disagreed*, while eighteen of 73 respondents (24.66%) *strongly disagreed* with the point, in combination 50.69%.

5.5.19.8 Language of publications i.e. mostly English

Twenty-two of 74 respondents (29.73%) *agreed* with the statement that language of publications influenced non-use of e-resources by academic staff, while 14 of 74 respondents (18.92%) *disagreed* with the point.

5.5.19.9 High cost of internet access

Interestingly, in answer to a question on the high cost of internet access as a factor that influenced non-use of e-resources by academic staff, the majority of respondents (34/73, 46.58%) *strongly disagreed* with the statement, and 28 of 73 (38.36%) *disagreed*.

5.5.19.10 Lack of time to search e-resources

The majority of the respondents indicated that they disagreed that lack of time to search e-resources influenced the non-use of e-resources by academic staff. Of the respondents, 27 of 76 (35.53%) *disagreed*, while 17 of 76 (22.37%) *strongly disagreed*, in combination 57%.

5.5.20 Factors that influence use of e-resources by academic staff

Question 20 (Appendix 3) asked about academic staff's perceptions of factors that influence *use* of e-resources. Although respondents were expected to respond to all options, often they did not. Therefore N differs, and is indicated in Table 5.51 per option.

Table 5.51 Factors that influence use of e-resources

Factors influencing use of resources	***N***	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
High quality of internet access providing a fast connection	73	-	-	3	4.11	9	12.33	38	52.05	23	31.51
Ease of use of e-resources, e.g. user-friendly interfaces	73	1	1.37	3	4.11	4	5.48	37	50.68	28	38.36
Availability of full-text articles	74	2	2.7	5	6.76	12	16.22	37	50	18	24.32
Good search skills	74	-	-	4	5.41	6	8.11	42	56.76	22	29.73
Training on use of e-resources	74	3	4.05	9	12.16	15	20.27	30	40.54	17	22.97
Experience in using e-resources	75	-	-	6	8	10	13.33	37	49.33	22	29.33 %
Good technical support when one encounters problems with e-resources	75	9	12	12	16	9	12	30	40	15	20
Increase in quality research output required by the university	75	-	-	6	8	10	13.33	37	49.33	22	29.33
Low cost of internet access	75	9	12	12	16	9	12	30	40	15	20

5.5.20.1 Internet connection speed

Thirty-eight of 73 (52.05%) academic staff *agreed* with the notion that high quality of internet access providing a fast connection was a factor influencing the use of e-resources by academic staff, while 23 of 73 (31.51%) *strongly agreed* with the point. Only a minority (3/73, 4.11 %) *disagreed*.

5.5.20.2 Ease of use of e-resources

The results indicated that 37 of 73 (50.68%) academic staff *agreed* that ease of use of e-resources, e.g. user-friendly interfaces, influenced the use of e-resources, while 28 of 73 (38.36%) *strongly agreed* with the notion.

5.5.20.3 Availability of full-text articles

Half of the academic staff (37 of 74, 50%) *agreed* that availability of full-text articles influenced the use of e-resources, while 18 of 74 (24.32%) *strongly agreed* with the point.

5.5.20.4 Good search skills

Over a third of the respondents (42/74, 56.76%) *agreed* that good search skills were an important factor influencing the use of e-resources by academic staff, while 22 of 74 respondents (29.73%) *strongly agreed* with the point.

5.5.20.5 Academic staff training on use of e-resources

Academic staff's perceptions of the influence of training on the use of e-resources were also ascertained. A majority of the academic staff agreed with the point. Of the respondents, 30 of 74 (40.54%) *agreed*, while 17 of 74 (22.97%) *strongly agreed* that training influenced the use of e-resources by academic staff at the universities.

5.5.20.6 Experience of using e-resources

Experience in using e-resources has also proven to be an important factor in enabling use of e-resources. Of the respondents, 37 of 75 (49.33%) indicated that they *agreed*, while 22 of 75 (29.33%) *strongly agreed* that experience in using e-resources enabled use of e-resources by academic staff. Only a minority of the respondents (6/75, 8%) *disagreed* with the point.

5.5.20.7 Good technical support

The influence of the need for good technical support when one encounters problems with e-resources was explored. Thirty of 75 (40%) respondents indicated that they *agreed*, while another 15 of 75 (20%) *strongly agreed* with the point.

5.5.20.8 Increase in quality research output

About half of respondents (37/75, 49.33%) *agreed* that increase in quality research output required by the university influenced the use of e-resources by academic staff, while 22 of 75 (29.33%) of the academic staff *strongly agreed* with the point.

5.5.20.9 Low cost of internet access

The majority *agreed* or *strongly agreed* with the point (i.e. 30/75, 40%, and 15/75, 20%, respectively.) Only a minority of respondents (9/75, 12%) *disagreed* with the point that low cost of the internet enabled use of e-resources by academic staff.

5.5.21 Perceptions of academic staff on e-resources provided by respective libraries meeting with their needs

Academics were asked whether e-resources in their respective libraries met their needs (Question 21, Appendix 3). The results are highlighted in table 5.52 below.

Table 5.52 Academic staff's perception of e-resources they needed for their work

Academic staff's perception of e-resources collection	*N*	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
		F	%	F	%	F	%	F	%	F	%
Type of materials covered	75	5	6.67	12	16	18	24	29	38.67	11	14.67
Scope of topics covered	75	4	5.33	11	14.67	21	28	30	40	9	12
Currency of materials (e.g. are resources up to date)	76	5	6.58	10	13.16	18	23.68	33	43.42	10	13.16
Availability of full text	76	4	5.26	9	11.84	15	19.74	37	48.68	11	14.47
Relevance to research objectives	76	4	5.26	8	10.53	12	15.79	43	56.58	9	11.84
Ease of access to full text articles	75	4	5.33	7	9.33	17	22.67	38	50.67	9	12

5.5.21.1 Type of materials covered by the libraries

A majority of the respondents *agreed* (29/75, 38.67%) that the type of materials covered by the respective libraries' e-resource collections met their needs, while 11 of 75 (14.67%) *strongly agreed* with the notion. Only (12/75, 16%) of the academic staff *disagreed* with the point.

5.5.21.2 Scope of topics covered by e-resources at the libraries

Thirty of 75 (40%) respondents *agreed* that the scope of topics covered by the e-resources met the needs of academics, while 9 of 75 (12%) *strongly agreed*.

5.5.21.3 Currency of e-resource materials

Thirty-three of 76 respondents (43.42%) *agreed* that the resources were up to date, while 10 of 76 (13.16%) *strongly agreed.* Another 10 of 76 (13.16%) *disagreed* with the notion.

5.5.21.4 Availability of full text

On investigating the perceptions of academics on the availability of the full text of e-resources, 37 of 76 (48.68%) *agreed* and 11/76 (31.58%) *strongly agreed* that full-text e-resources were available.

5.5.21.5 Relevance of resources to research objectives

As regards the relevance of resources to the research field or fields in which academic staff work in, the findings were that 43 of 76 (56.58%) academic staff *agreed*, with an additional 9 of 76 (11.84) academic staff *strongly agreeing*. Only a minority (8/76, 10.53%) *disagreed* and four of the 76 (5.26%) *strongly disagreed* with the statement.

5.5.21.6 Ease of access to resources

Another significant investigation highlighted in the table was to determine the ease of access to e-resources for academic staff. In this investigation 38 of 75 (50.67%) *agreed*, while an additional 9 of 75 (12%) academic staff surveyed *strongly agreed*. Only seven of 75 (9.33%) of the academic staff *disagreed* with the point.

5.5.22 Academic staff's likelihood of using e-resources for research purposes

Table 5.53 shows the results when academic staff was asked about the likelihood of using e-resources in different circumstances (Question 22, Appendix 3).

The results indicate that 35/74 (47.30%) *agreed* while 25/74 (33.78%) *strongly agreed* that they would use the e-resources for research purposes if they knew about the resources available at their institutional libraries. In combination, 60% *agreed* or *strongly agreed* with the notion.

Almost half of the respondents (37/76, 48.68%) agreed while 21/76 (27.63%) *strongly agreed* that they would use the e-resources for research purposes if their library trained them on using e-resources.

Half of the repondents (36/73, 49.32%) *agreed* that they would use the e-resources for research purposes if they had better access to databases that they needed at the institution, while a further 22/73 (30.14%) *strongly agreed* with the statement.

Over a third of the respondents 26/73 (35.62%) *agreed* while 16/73 (21.92%) *strongly agreed* that they would use the e-resources if electricity supply was more stabe at their institution. Only eleven of 73 (15.07%) *strongly disagreed* with the sentiment.

Thirty-two of 76 (42.11%) *agreed* that they would use the e-resources if they had stable internet access at the institution. A further 22/76 (28.95%) respondents *strongly agreed*.

About a third of the repondents 23/76 (30.26%) *agreed* that they would use the resources if internet connectivitiy from home was cheaper. A further 30/76 (39.47%) strongly agreed.

Table 5.53 Academic staff's likelihood of using e-resources for research purposes

Academic staff's likelihood of using e-resources	**N**	**Strongly disagree**		**Disagree**		**Neither disagree nor agree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
I knew more about e-resources available at my institution	74	4	5.41	4	5.41	6	8.11	35	47.3	25	33.78
My library would train me on using e-resources	76	7	9.21	5	6.58	6	7.89	37	48.68	21	27.63
I had better access to databases that I need at my institution	73	2	2.74	4	5.48	9	12.33	36	49.32	22	30.14
Electricity supply was more stable at my institution	73	11	15.07	7	9.59	13	17.81	26	35.62	16	21.92
I had stable internet access at my institution	76	7	9.21	8	10.53	7	9.21	32	42.11	22	28.95
There were no restrictions on internet access at the institution	74	7	9.46	10	13.51	10	13.51	28	37.84	19	25.68
Internet connectivity from home was cheaper	76	9	11.84	5	6.58	9	11.84	23	30.26	30	39.47

5.5.23 Training received by academic staff

Asked if the academic staff had received training from the libraries on the use of e-resources (Question 23, Appendix 3), the results are as presented in Table 5.54 below. The majority of the academic staff respondents indicated that they had received training on databases (38/62, 61.29%), on e-journals (55/75, 73.33%) and on Google Scholar (40/70, 57.14%).

Table 5.54 Training on e-resources received by academic staff

Training received by academic staff	***N***	**Yes**		**No**	
		F	%	F	%
Database	62	38	61.29	24	38.71
E-journals	75	56	74.67	19	25.33
Google Scholar	70	40	57.14	30	42.86

5.5.24 Academic staff's competence in using databases

The results of academic staff's responses on their self-rated skills and competence in using databases (Question 24, Appendix 3) are presented in Table 5.55 below. About a third of the respondents indicated *fair* skills in all three of the key databases selected for this question i.e. 22 of 76 (28.95%) for Google Scholar; 26 of 74 (35.14%) for CAB Abstracts and 19 of 70 (27.14%) for PubMed. For Google Scholar 12 of 76 (15.79%) and 31 of 76 (40.79%) reported *good* and *very good* skills respectively in using the databases, while only six of 70 (8.57%) and 18 of 70 (25.71%) reported *good* and *very good* skills in using PubMed.

As discussed in the literature review (section 3.2.1) user skills in the three e-resources (i.e. Google Scholar, CAB Abstracts and Pubmed) featured as important skills for academic staff and students to enable them to effectively carryout research and teaching duties in STM disciplines.

Table 5.55 Academic staff's competence in using databases

	N	**Very poor**		**Poor**		**Fair**		**Good**		**Very good**	
		F	%	F	%	F	%	F	%	F	%
Google Scholar	76	5	6.58	6	7.89	22	28.95	12	15.79	31	40.79
CAB Abstracts	74	13	17.57	17	22.97	26	35.14	8	10.81	10	13.51
Pubmed	70	16	22.86	11	15.71	19	27.14	6	8.57	18	25.71

5.6 FINDINGS FROM POST-GRADUATE STUDENTS IN STM DISCIPLINES

Master's and doctoral students were also included in the investigations. Findings from postgraduate students in the STM disciplines are presented in the following sections. The results are referenced per question from Appendix 4: Questionnaire for postgraduate students in STM disciplines. The researcher, with the assistance of two enumerators, visited the universities and handed out the questionnaires to the students. Print-based self-administered questionnaires were used to collect data.

Of the 450 postgraduate-students approached, 136 returned filled-in questionnaires. The figures and tables explain data on participant's profiles, how they access the internet and use the available library e-resources, the factors that influence the use and non-use of the e-resources, the training they have received on e-resources and their competences in the use of e-resources. Tables and figures have been presented on some data sets to clarify the data analysis results (where this was not necessary, only the figure or table is presented). The applicable question numbers are referenced in each of the following sections.

5.6.1 Profiles of postgraduate students in STM disciplines: distribution by university

Respondents were drawn from the five universities in Zimbabwe offering STM postgraduate degrees (Question 1, Appendix 4). Figure 5.34 and Table 5.56 below show the distribution of postgraduate STM students by university. UZ (43/135, 31.85%) yielded the largest number of students, while the smallest number came from MSU (12/135, 8.89%) and AU (14/135, 10.37%). Postgraduate students includes both master's and doctoral students.

Figure 5.34 Profiles of postgraduate students in STM disciplines

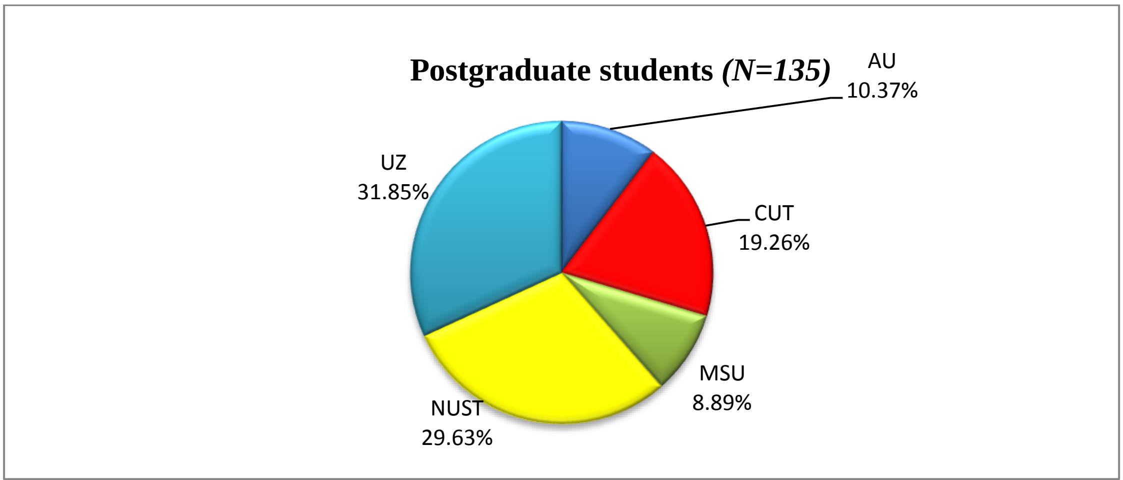


Table 5.56 Profiles of postgraduate students in STM disciplines

Student distribution by university *(N=135)*	F	%	Cumulative F	Cumulative %
AU	14	10.37	14	10.37
CUT	26	19.26	40	29.63
MSU	12	8.89	52	38.52
NUST	40	29.63	92	68.15
UZ	43	31.85	135	100

5.6.2 Postgraduate students in STM disciplines: distribution by age

The descriptive statistics for the age ranges of respondents are shown in Table 5.57 and Figure 5.35 (Question 2, Appendix 4). The age of postgraduate students in STM disciplines ranged from a minimum of 22 to a maximum of 53, a range of 31 years. The majority of students were between the ages of 29 and 35 (48/113, 42.47%), followed by almost a third (35/113, 30.97%) of postgraduate students in the age range of 22 to 28, while only 12 of 113 (10.62%) postgraduate students were between 43 and 53 years old. The intervals are based on the responses grouped to cover the entire range of responses.

One hundred and thirteen postgraduate students answered this question. The postgraduate students' mean age was 32.5 years with a standard deviation of 6.97.

Figure 5.35 Postgraduate students in STM: distribution by age

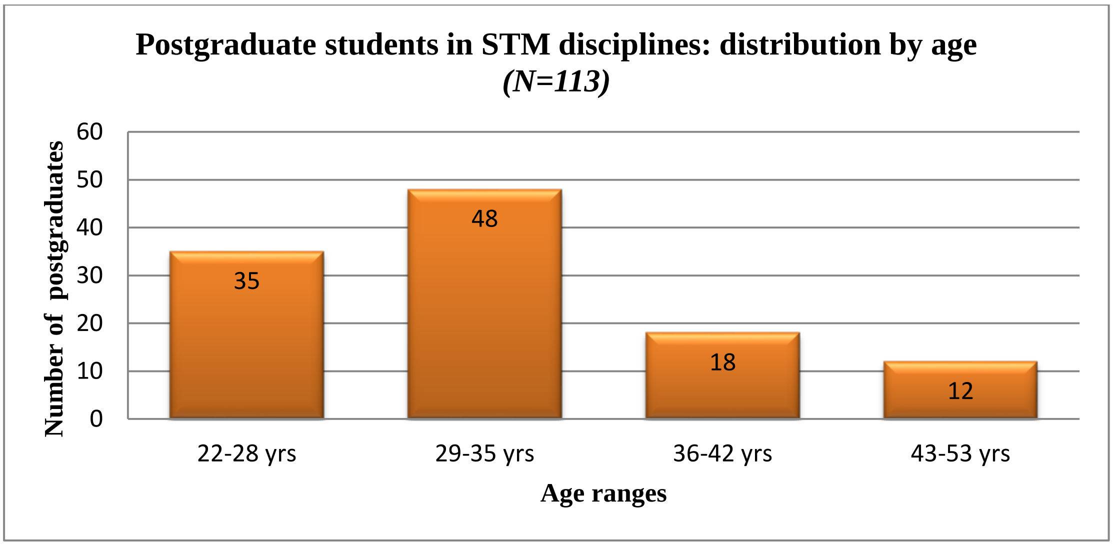


Table 5.57 Postgraduate students in STM disciplines: distribution by age

Age ranges (*N=113*)	F	%
22 - 28 years	35	30.97
29 - 35 years	48	42.47
36 - 42 years	18	15.93
43 - 53 years	12	10.62

5.6.3 Postgraduate students in STM disciplines: distribution by faculty

Question 3 (Appendix 4) asked about the faculties in which the postgraduate students were studying. One hundred and thirty two students responded to this question. The results as represented in Table 5.58 below highlight that the Faculty of Agriculture (70/132, 53.03%) had the majority of postgraduate student respondents, followed by the Faculties of Science and Technology, which had 28 of the 132 (21.21%) respondents. The faculties with the lowest number of student respondents were the Faculty of Environment Sciences (1/132, 0.76%) and the Faculty of Natural Sciences (4/132, 3.03%).

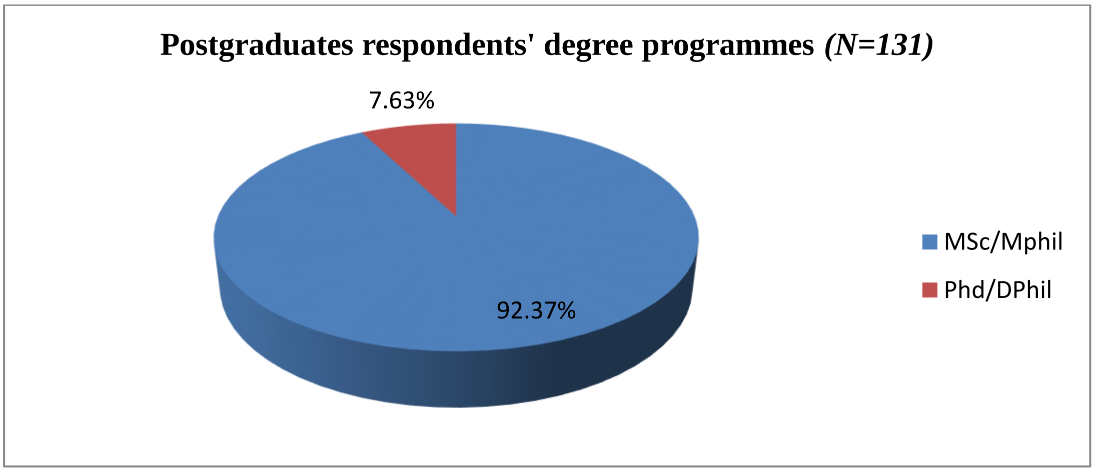
Table 5.58 Postgraduate students in STM disciplines: distribution by faculty

Faculty *(N=132)*	**F**	**%**
Agriculture	70	53.03
Science and Technology	28	21.21
Medicine or Health	24	18.18
Environment Sciences	1	0.76
Natural Sciences	4	3.03
Veterinary Science	5	3.79

5.6.4 STM postgraduate students by degree programmes

Question 4 (Appendix 4) asked about the degree programmes for which postgraduate students were registered. Most were in MSc or MPhil programmes (121/131, 92.37%), with the rest (10/131, 7.63%) registered for PhD or DPhil programmes. The results are reflected in Figure 5.36, below.

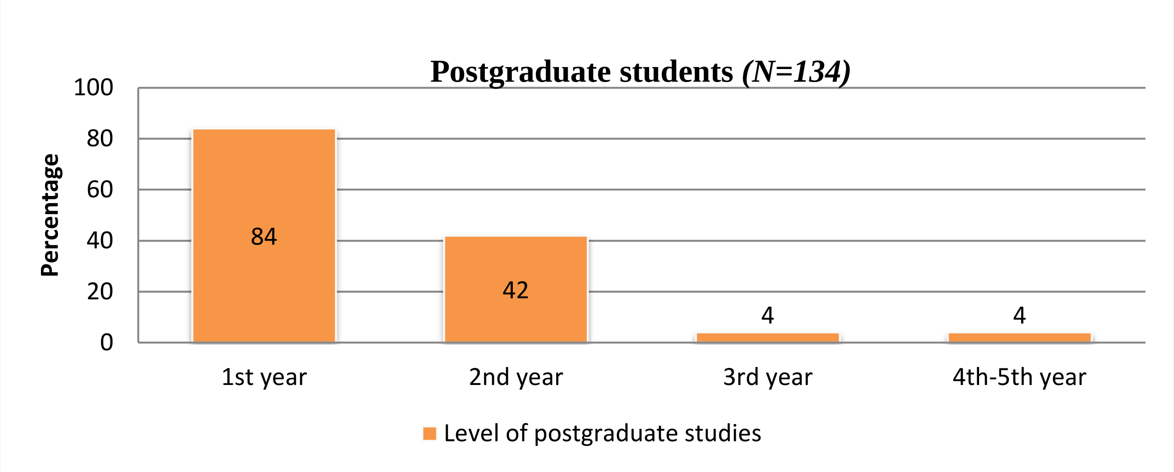
Figure 5.36 Postgraduate students' respondents by degree programme



5.6.5 Level of postgraduate students in STM degree programmes

Question 5 (Appendix 4) asked the level the postgraduate were in. The question did not distinguish between master's and doctoral students. One hundred and thirty-four postgraduate students answered the question. The results are depicted in Figure 5.37 below.

Figure 5.37 Level of postgraduate students in STM discipline degree programmes



The results reflect that almost two-thirds of postgraduate students (84/134, 62.69%) were in their first year, followed by almost a third (42/134, 31.34%) in their second year. The third and fourth year levels had the lowest number of postgraduate student respondents. They both had four out of the 134 (2.99%) students. The result did not distinguish between master's and doctoral students as neither were asked to state their study programme for this question.

5.6.6 Research papers or book chapters published

The postgraduate students were asked to report how many research papers (scholarly journal articles), book chapters, patents and conference papers they had published in the 24 months preceding the data collection (Question 6, Appendix 4). Although respondents were expected to respond to all options, often they did not. Therefore N differs, and is indicated in the following sections**.** The data is presented according to type of publication.

5.6.6.1 Scholarly journals

Forty-four students answered this question. Table 5.59 below shows that about a third (15/44, 34.09%) of postgraduate students had published one scholarly journal article, while only (2/44, 4.55%) had published six papers. Only one student had published more than six papers, namely 35 (This might be a mistake). Twelve of 44 (27.27%) reported that they had never published.

Table 5.59 Scholarly papers published by postgraduate students

Scholarly papers *N=44*	F	%	Cumulative F	Cumulative %
0	12	27.27	12	27.27
1	15	34.09	27	61.36
2	6	13.64	33	75
3	3	6.82	36	81.82
4	5	11.36	41	93.18
6	2	4.55	43	97.73
35*	1	2.27	44	100

*Figure checked in questionnaire

5.6.6.2 Books or book chapters

Twenty-eight picked this option. Only one of the 28 postgraduate respondents had published two book chapters. Four reported publishing a book chapter each during the 24-months preceding data collection. None of the students had published a book.

5.6.6.3 Patents

Only one patent had been registered by a student in the 24 months preceding the data collection.

5.6.6.4 Conference attendance

Thirty-six answered this question. As indicated in Table 5.60, 13 students (36.11%) have never presented at a conference, while eight (22.22%) reported that they had made a presentation at a conference. One student reported making presentations at seven conferences during the 24 months preceding data collection.

Table 5.60 Conference presentations

Conferences *(N=36)*	F	%	Cumulative F	Cumulative %
0	13	36.11	13	36.11
1	8	22.22	21	58.33
2	5	13.89	26	72.22
3	2	5.56	28	77.78
4	5	13.89	33	91.67
5	2	5.56	35	97.22
7	1	2.78	36	100

5.6.7 Access to internet by postgraduate students

Table 5.61 below presents the results of an investigation into the type of internet connection postgraduate students used (Question 7, Appendix 4). Although respondents were expected to respond to all options, often they did not. N differs per option and is indicated in the table.

Table 5.61 Access to internet

Access to internet	***N***	**Yes**		**No**	
		F	%	F	%
Do not access the internet	41	6	14.63	35	85.37
Internet connection at home only	46	11	23.91	35	76.09
Internet connection at work only	67	46	68.66	21	31.34
Internet connection at work and home	88	71	80.68	17	19.32
Internet café	55	44	80	11	20

5.6.7.1 Internet both at work and home

The majority (71/88, 80.68%) of the postgraduate students indicated that they accessed internet both at work and home, while 17 of 88 (19.32%) said that they did not have access to the internet either at work or at home.

5.6.7.2 Internet at home

Only 11 out of 46 (23.91%) of the students had an internet connection at home, while three quarters (35/46, 76.09%) reported that they did not have access to the internet at home.

5.6.7.3 Internet only at work

More than two-thirds of the students (46/67, 68.66%) had internet access only at work, while almost a third (21/67, 31.34%) indicated that they did not access the internet at their workplaces.

5.6.7.4 Internet cafés

The use of internet cafés to access the internet was reported by the majority (44/55, 80%) of postgraduate students, while 11 of the 55 (20%) who took part in the study indicated that they did not make use of internet cafés to access the internet.

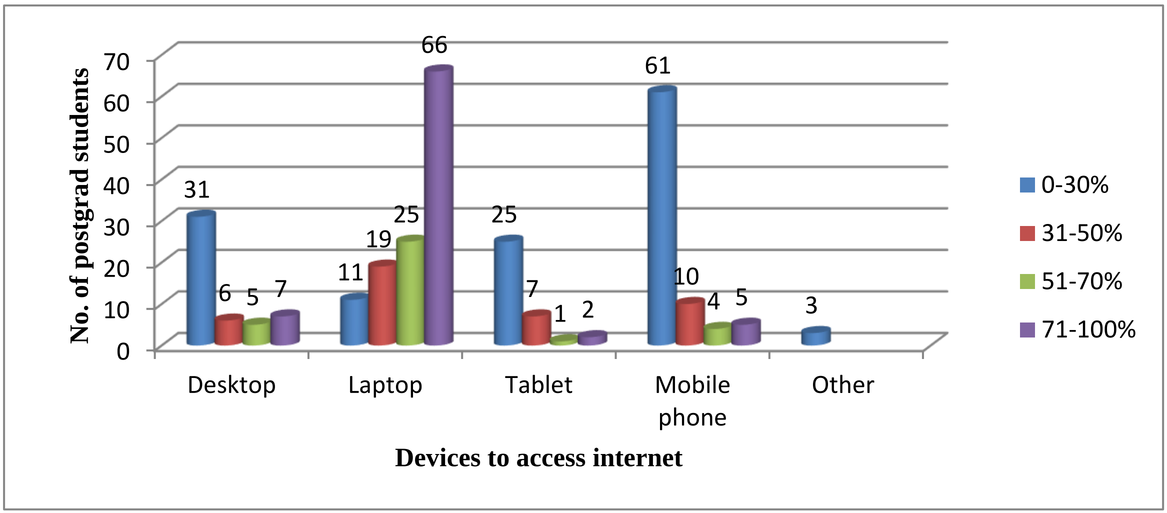
5.6.8 Type of device used by postgraduate students to access the internet

Question 8 (Appendix 4) asked about the type of device postgraduate students used to access the internet. The results are presented in Table 5.62 and Figure 5.38 below and explained in the following sections. Respondents were able to select more than one device.

Table 5.62 Types of devices used by postgraduate students to access the internet

Types of devices used by postgraduate students to access the internet	Desktop computer	Laptop	Tablet (e.g. iPad, Galaxy)	Mobile phone	Other
N	49	121	35	80	3
Mean	34.1	72.68	25.5	26.1	2.33
Std dev	27.3	25.27	20.5	22.7	2.52
Minimum	4	2	5	0	0
Maximum	90	100	80	99	5

Figure 5.38 Type of device postgraduate students use to access the internet



5.6.8.1 Desktop computer

The majority (31/47, 63.26%) of postgraduate students used a desktop computer up to 30% of the time when accessing the internet, whereas five out of 47 (10.20%) used it up to about 70% of the time. The students that made use of the desktop reported an average of 34.1% with a standard deviation of 27.3%.

5.6.8.2 Laptop computer

More than half of postgraduate students (66/121, 54.54%) made use of a laptop between 71% and 100% of the time when accessing the internet, while only 11 of 121 respondents (9.09%) made use of a laptop up to 30% of the time when accessing the internet. The students that made use of a laptop had a mean of 72.68% with a standard deviation of 22.27%.

5.6.8.3 Tablet

The majority of students (25/35, 71.4%) surveyed used a tablet up to 30% of the time when accessing the internet and almost a quarter (7/35, 20%) of postgraduate students used a tablet 31-50% of the time when accessing the internet. The students who made use of the tablet to access the internet had a mean of 25.5% with a standard deviation of 20.5%.

5.6.8.4 Mobile phone

The majority (61/80, 76.25%) of postgraduate students used a mobile phone up to 30% of the time when accessing the internet, while only four of 80 (5%) made use of a mobile phone up to about 70% of the time they accessed the internet. The postgraduate students who made use of a mobile phone to access the internet had a mean of 26.1% and standard deviation of 22.7.

5.6.9 Options of accessing full text of journal articles

The perceptions of postgraduate students of their options when accessing full-text articles were investigated (Question 9, Appendix 4). Table 5.62 below present the results of the investigation. Sub-sections 5.5.9.1 to 5.5.9.8 below discuss results for each option.

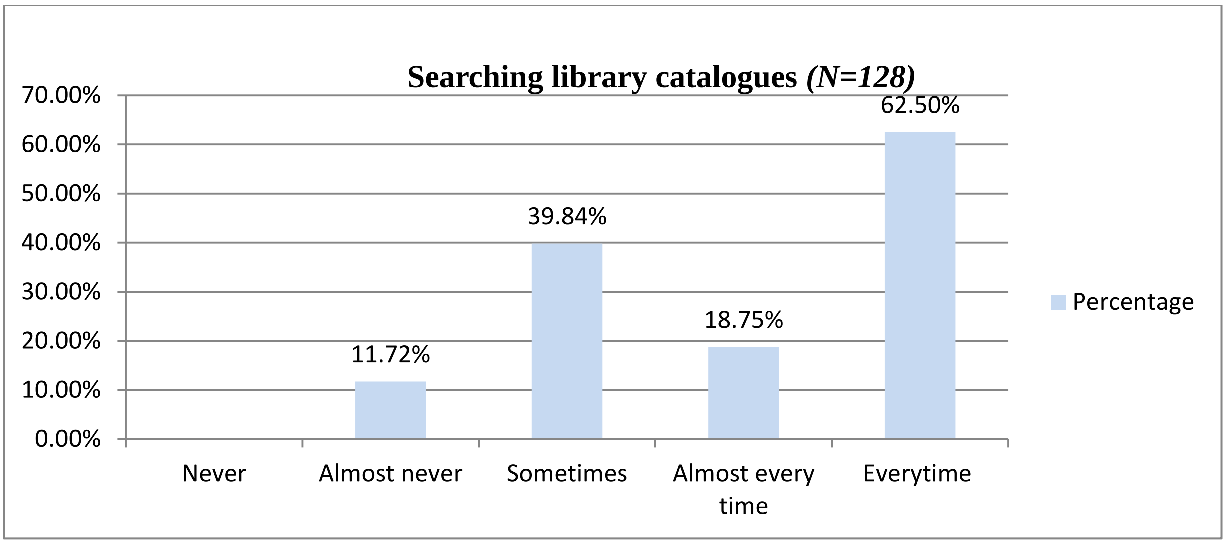
Table 5.62 Options of accessing full text of journal articles

Options of accessing full text of journal articles	***N***	**Never**		**Almost never**		**Sometimes**		**Almost every time**		**Every time**	
		F	%	F	%	F	%	F	%	F	%
Search in the library catalogue	128	30	23.44	15	11.72	51	39.84	24	18.75	8	6.25
Databases (including e-journals and e-books)	126	10	7.94	8	6.35	61	48.41	31	24.6	16	12.7
Google Scholar	134	6	4.48	13	9.70	47	35.07	44	32.84	24	17.91
General search engines (e.g. Google, Bing)	129	1	0.78	3	2.33	37	28.68	49	37.98	39	30.23
Institutional repositories	123	39	31.71	26	21.14	43	34.96	12	9.76	3	2.44
Database for theses and dissertations	130	19	14.62	27	20.77	53	40.77	22	16.92	9	6.92

5.6.9.1 Search in the library catalogue

Less than a fifth of the postgraduate student respondents (24/128, 18.75%) *almost every time* searched in the library catalogue for journals and only eight of 128 (6.25%) searched the library catalogue e*very time.* Fifty-one of 128 (39.84%) searched it *sometimes.* (Figure 5.39, below)

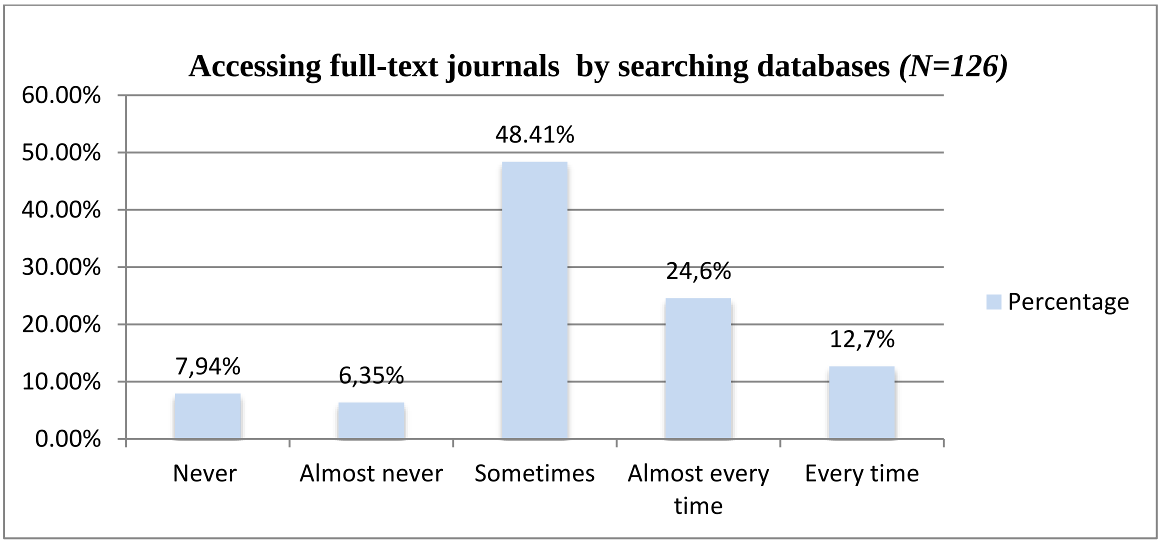
Figure 5.39 Options of accessing full-text journals by searching in library catalogue



5.6.9.2 Databases (including e-journals and e-books)

Almost half the postgraduate students (61/126, 48.41%) used databases to access journals *sometimes*, while only 31 of 126 (24.6%) accessed journals through databases *almost every time*. Only 16 of 126 (12.7%) accessed journals through databases *every time* (Figure 5.40 below).

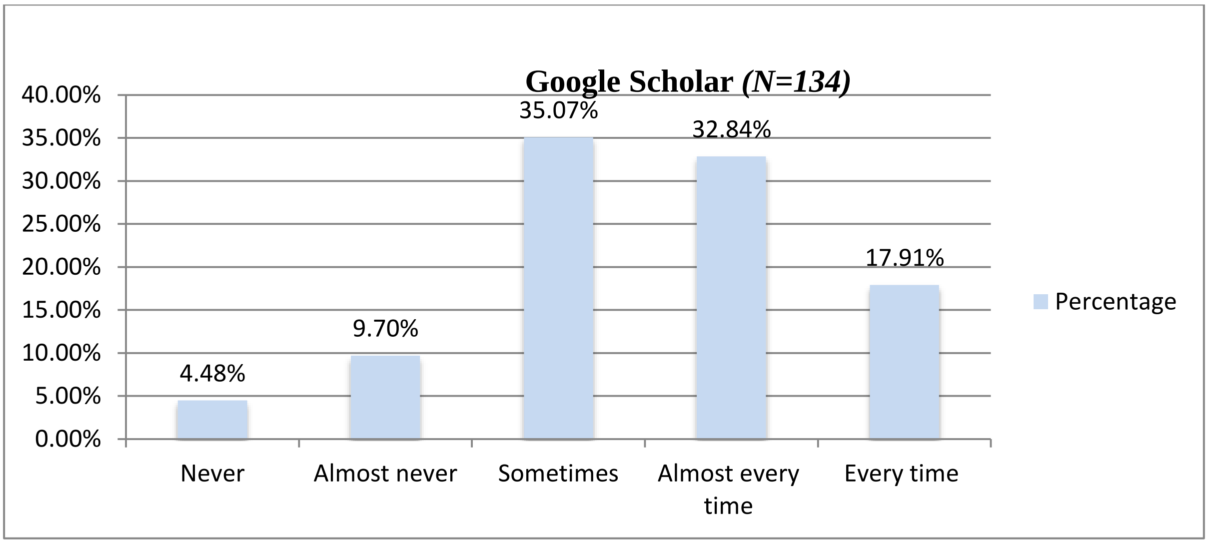
Figure 5.40 Accessing full-text journals by searching databases



5.6.9.3 Google Scholar

In Figure 5.41 below the results reflect that more than a third (47/134, 35.07%) of post-graduate students in SMT used Google Scholar *sometimes* to access journal articles, a third (44/134, 32.84%) used Google Scholar *almost every time* and 24 of 134 (17.91%) used Google Scholar when accessing journal articles *every time*.

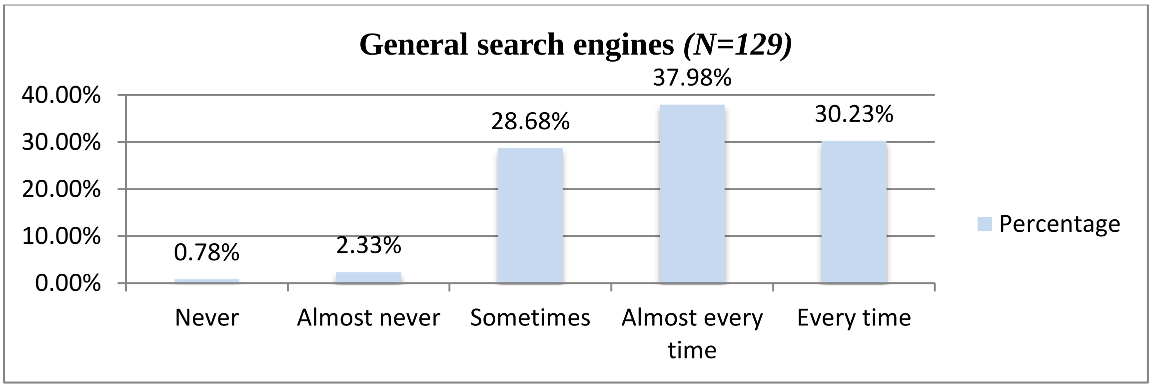
Figure 5.41 Accessing full-text journals via Google Scholar



5.6.9.4 Accessing full-text articles via general search engines

In the study (Figure 5.42, below) a positive attitude was displayed in the use of general search engines (e.g. Google and Bing) to search journals: more than a third (49/129, 37.98%) of postgraduate students used general search engines when accessing journal articles *almost every time*, while 39 of 129 (30.23%) used general search engines (e.g. Google, Bing) *every time* when accessing journal articles.

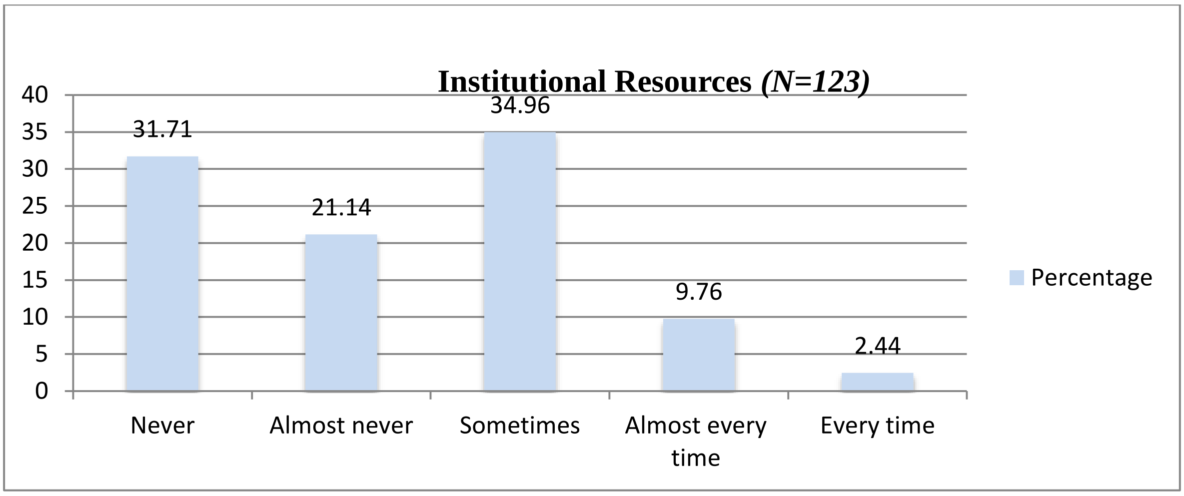
Figure 5.42 Accessing full-text journal articles via general search engines



5.6.9.5 Institutional repositories

The findings (Figure 5.43 below) reflect that 39 of 123 (31.71%) postgraduate students have *never* used institutional repositories to access journal articles, while 26 of 123 (21.14%) *almost never* used institutional repositories to access journal articles.

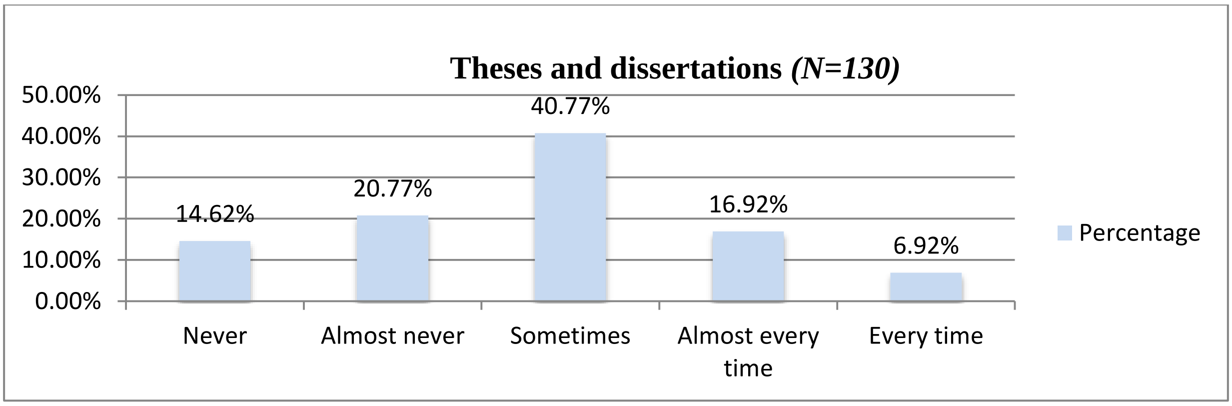
Figure 5.43 Accessing full-text journal articles through institutional repositories



5.6.9.6 Database for theses and dissertations

Postgraduate students in the study (Figure 5.44) stated that 19 of 130 (14.62%) of them had *never* used databases of theses and dissertations to access journal articles, while 27 of 130 (20.77%) had *almost never* used databases of theses and dissertations to access journal articles and almost half of the respondents (53/130, 40.77%) had used databases for theses and dissertations *once in a while* (sometimes).

Figure 5.44 Accessing full-text journal articles for theses and dissertations



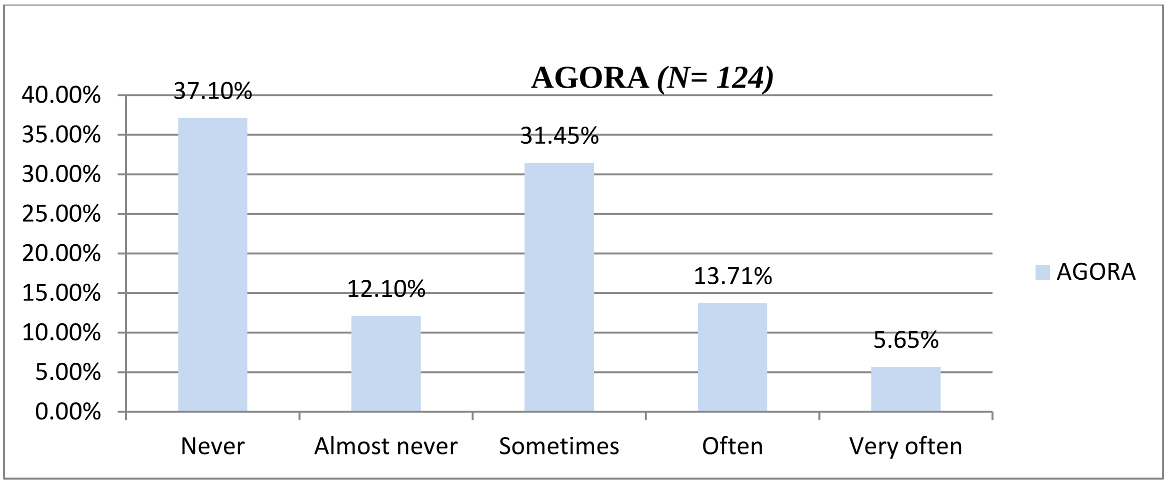
5.6.10 Frequency of use of e-resources by postgraduate students

The following sections summarise the results of an investigation into the frequency of use of e-resources by STM postgraduate students (Question 10, Appendix 4).

5.6.10.1 AGORA

The results shown below in Figure 5.45 reflect that 24 of 124 respondents (19.35%) used AGORA *often* or *very often*, while almost half (61/124, 49.19%) of the postgraduate student respondents had *never* used or *almost never* used AGORA. On the other hand, 39 of 124 respondents (31.45%) reported that they used AGORA *once in a while* (sometimes).

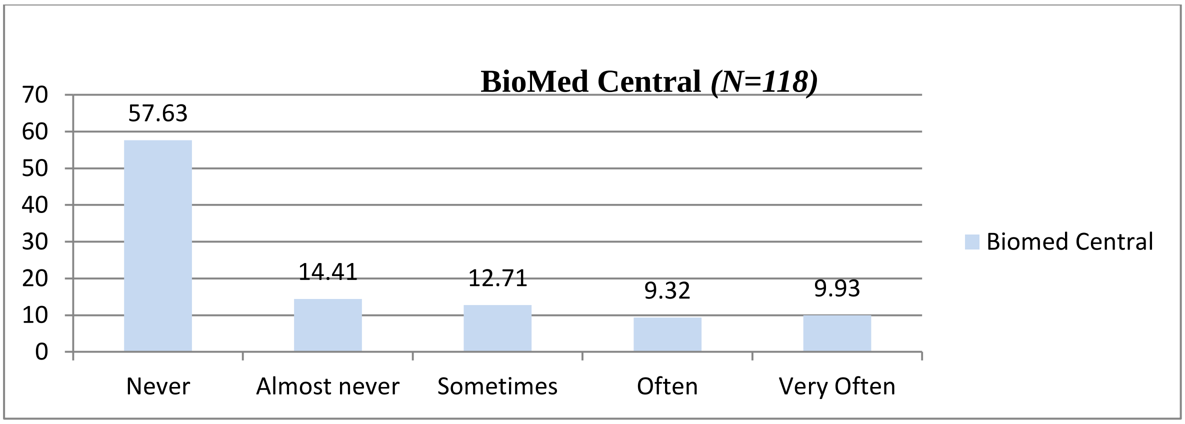
Figure 5.45 Use of AGORA by postgraduate students



5.6.10.2 Biomed Central

Figure 5.46 below shows that 68 of 118 postgraduate students (57.62%) had never used BioMed Central, while only 15 of 118 respondents (12.71%) had used BioMed Central *once in a while*.

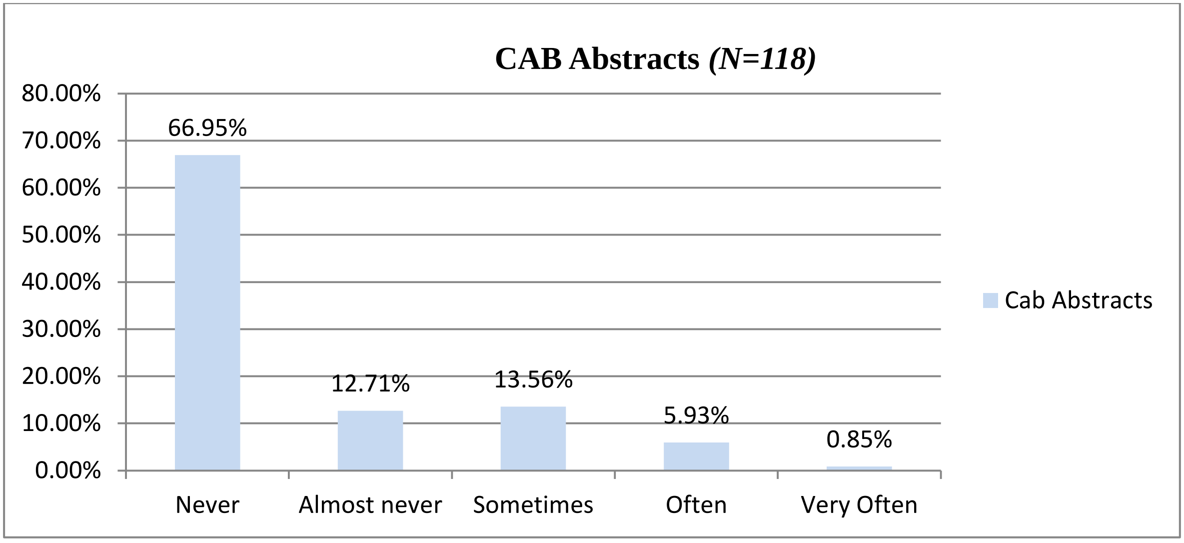
Figure 5.46 Use of BioMed Central by postgraduate students



5.6.10.3 CAB Abstracts

The results shown below in Table 5.47 indicate that two thirds (79/118, 66.95%) of post-graduate students had *never* used CAB Abstracts, while one 8 of 118 (6.78%) postgraduate student in STM *often* or *very often* used CAB Abstracts.

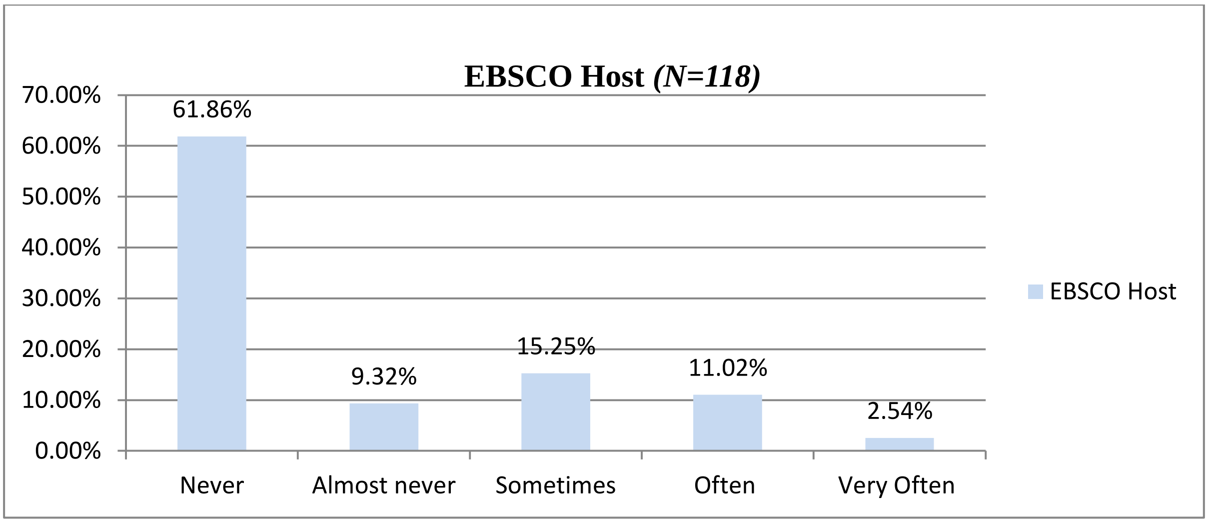
Figure 5.47 Use of CAB Abstracts by postgraduate students



5.6.10.4 EBSCO Host

About two-thirds of postgraduate student respondents (73/118, 61.86%) had *never* used EBSCO Host, while 18 of 118 (15.25%) reported that they used EBSCO Host *sometimes.* In combination, 84/118 (71.18%) had *almost never* or *never* used it. (Figure 5.48).

Figure 5.48 Use of EBSCO Host by postgraduate students



The results in Table 5.63 below show that the databases reported to be used most often were AGORA, with a total of 24 of 124 (19.36%) postgraduate students indicating that they used it *very often* or *often* and PubMed, with 23 of 119 (19.32%) reporting that they used it *often* or *very often*. This was followed by BioMed Central (18/118, 15.25%), EBSCO (16/118, 13.56%) and then TEEAL (14/118, 11.86%) for *often* or *very often*. It is important to note that AGORA was reported to be used *sometimes* by a majority of the postgraduate students in STM (39/124, 31.45%).

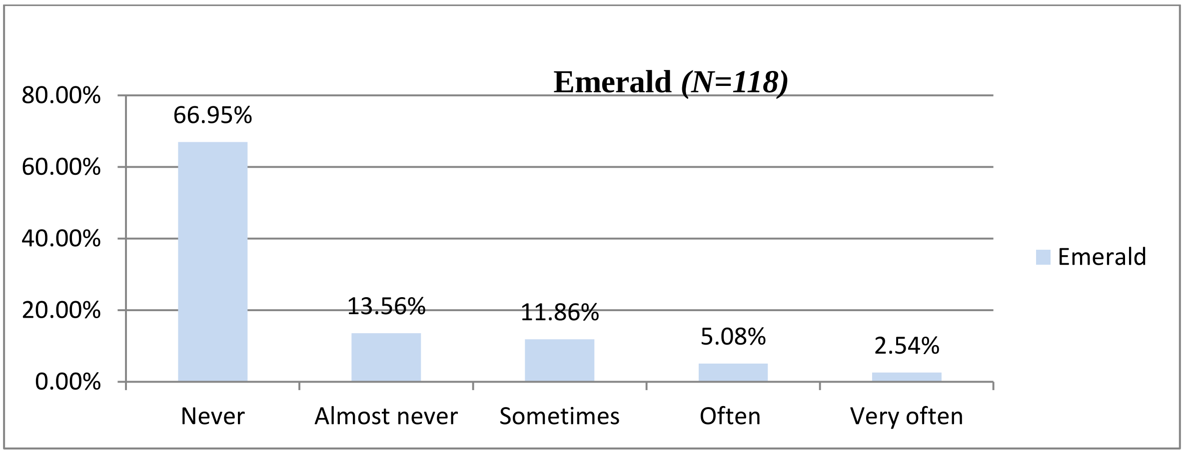
Table 5.63 Frequency of use of databases by postgraduate students in STM

E-resources	*N*	Never		Almost never		Sometimes		Often		Very often	
		F	%	F	%	F	%	F	%	F	%
AGORA	124	46	37.1	15	12.1	39	31.45	17	13.71	7	5.65
BioMed Central	118	68	57.63	17	14.41	15	12.71	11	9.32	7	5.93
CAB Abstracts	118	79	66.95	15	12.71	16	13.56	7	5.93	1	0.85
EBSCO Host	118	73	61.86	11	9.32	18	15.25	13	11.02	3	2.54
Emerald	118	79	66.79	16	13.56	14	11.86	6	5.08	3	2.54
HIGHWIRE	118	87	73.73	16	13.56	11	9.32	3	2.54	1	0.85
HINARI	116	49	42.24	20	17.24	25	21.55	14	12.07	8	6.9
JSTOR	117	67	57.26	16	13.68	21	17.95	10	8.55	3	2.56
OARE	116	86	74.14	12	10.34	12	10.34	6	5.17	-	-
PubMed	119	65	54.62	13	10.92	18	15.13	13	10.92	10	8.4
TEEAL	118	80	67.8	6	5.08	18	15.25	12	10.17	2	1.69

5.6.10.5. Emerald

Figure 5.49 below shows that more than two-thirds (79/118, 66.79%) of postgraduate students had *never* used Emerald, while three of 118 respondents (2.54%) used the database *very often.*

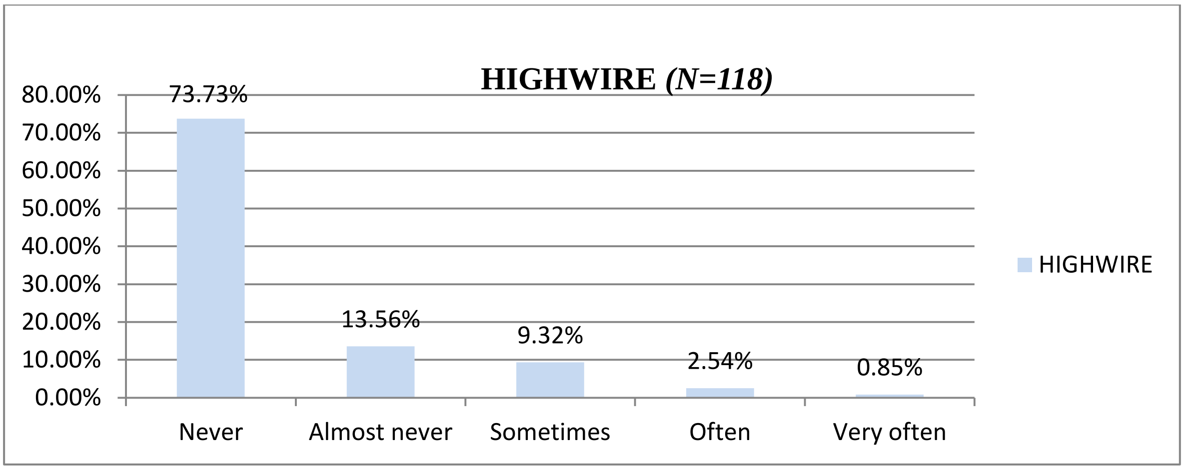
Figure 5.49 Use of Emerald by postgraduate students



5.6.10.6 HIGHWIRE

Figure 5.50 below shows that about three-quarters (87/118, 73.73%) of postgraduate students had *never* used HIGHWIRE, while only 11 of 118 (9.32%) postgraduate students had used HIGHWIRE *sometimes*.

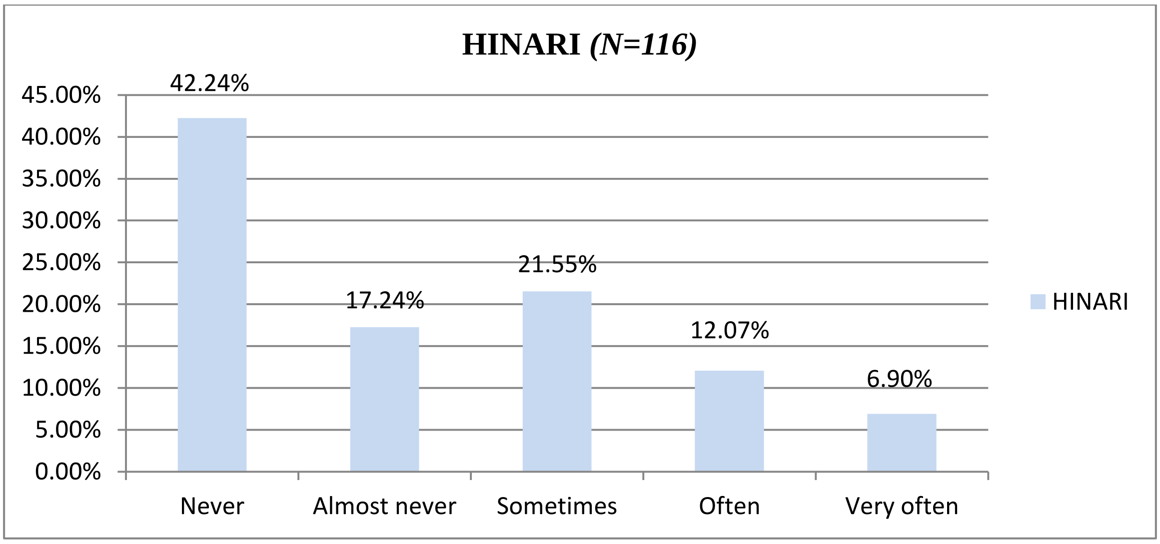
Figure 5.50 Use of HIGHWIRE by postgraduate students



5.6.10.7 HINARI

Figure 5.51 below shows that over a third (49/116, 42.24%) of postgraduate student respondents in STM had *never* used HINARI, while (20/116, 17.24%) had *almost never* used the resource and almost a quarter (25/116, 21.55%) indicated that they had used HINARI *sometimes.* In combination, only 18.97% had used it *often* or *very often*.

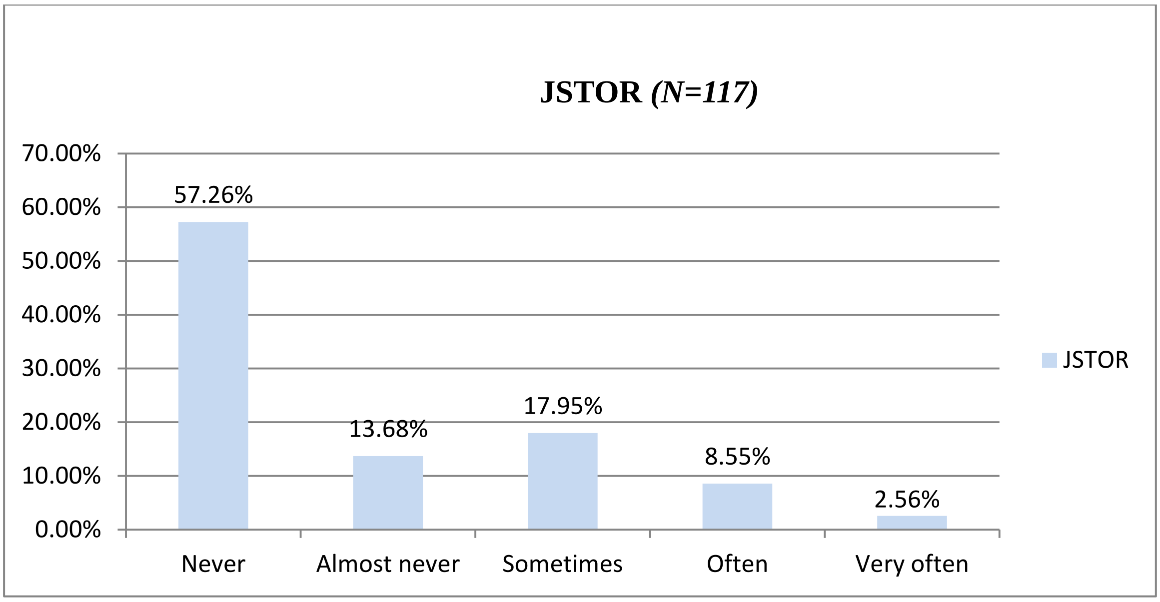
Figure 5.51 Use of HINARI by postgraduate students



5.5.10.8 JSTOR

The results show that more than half (67/117, 57.26%) of postgraduate students had never used JSTOR, while 13 of 117 (11.11%) postgraduate students *often* or *very often* used it. (Figure 5.52).

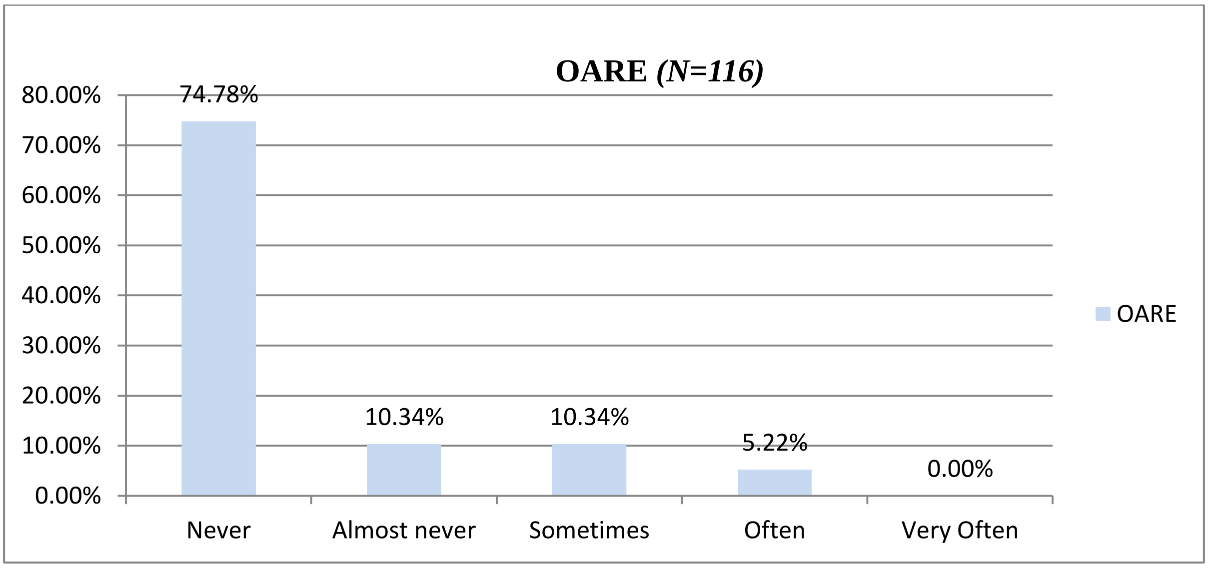
Figure 5.52 Use of JSTOR by postgraduate students



5.6.10.9 OARE

The results reflect that almost three-quarters (86/116, 74.14%) of postgraduate students had *never* used OARE, while six of 116 (5.17%) postgraduate students in STM *often* used OARE (Figure 5.53).

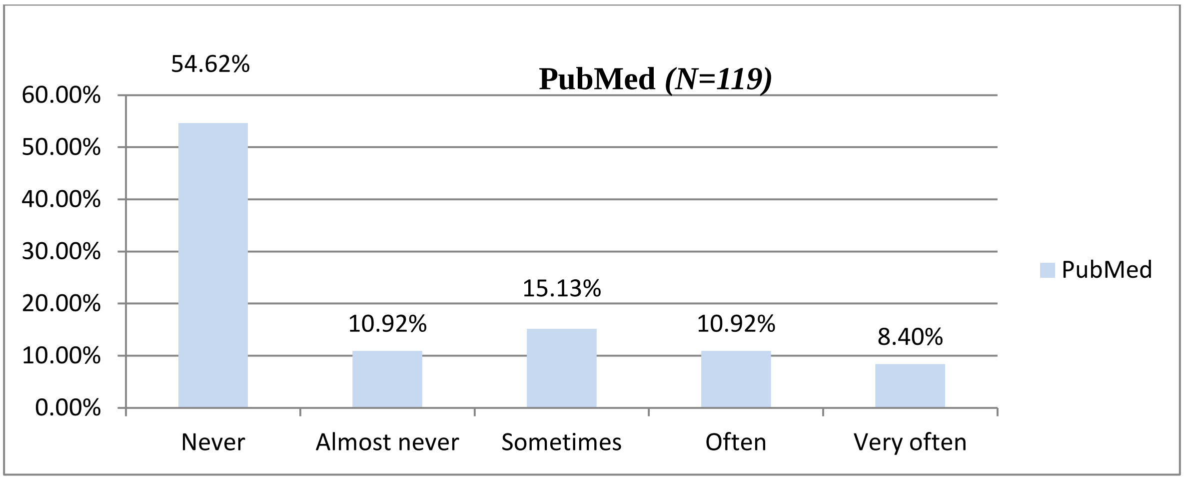
Figure 5.53 Use of OARE by postgraduate students



5.6.10.10 PubMed

Figure 5.54 below shows that in the study more than half (65/119, 54.62%) of postgraduate students had *never* used PubMed, while 10 of 119 (8.40%) *very often* used PubMed. In combination, only 23 of 119 (19.32%) used it *often* or *very often.*

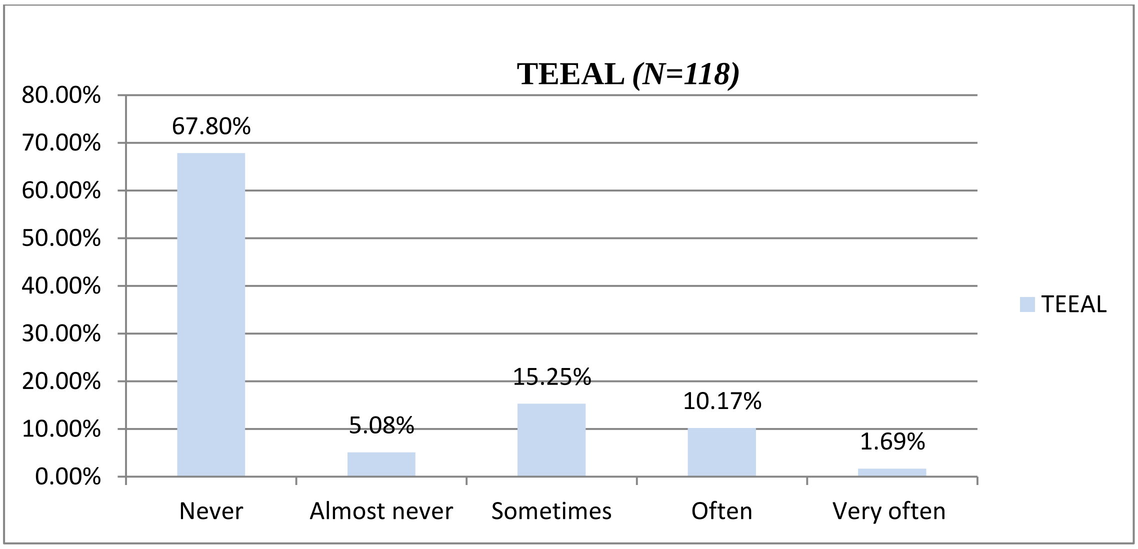
Figure 5.54 Use of PubMed by postgraduate students



5.6.10.11 TEEAL

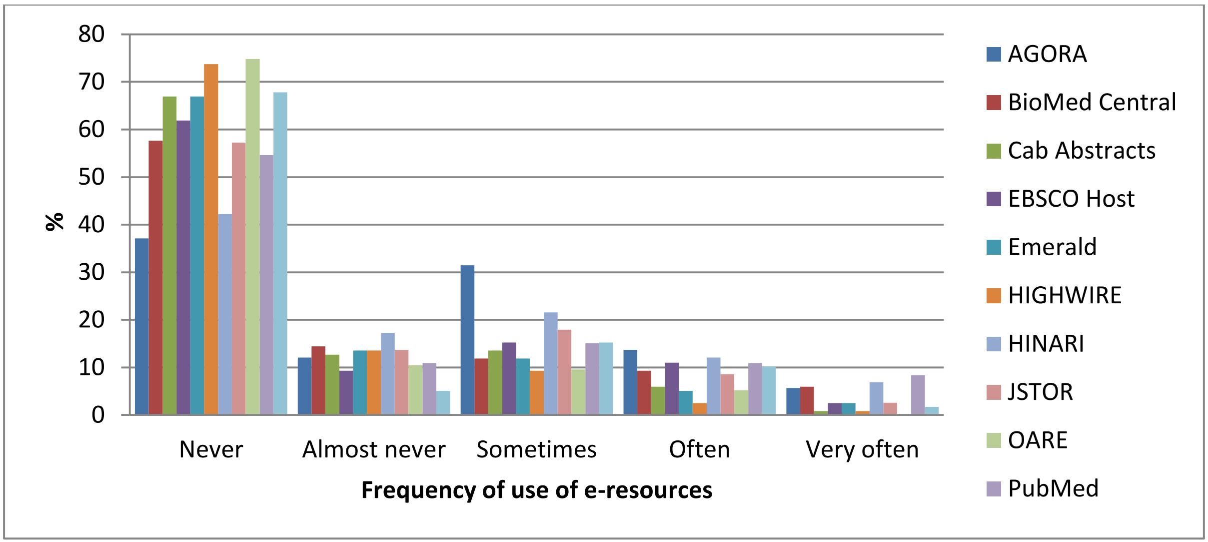
About two-thirds (80/118, 67.80%) of postgraduate students indicated that they had *never* used TEEAL. Only 14 of 118 (11.86%) of the respondents *often* or *very often* used TEEAL (Figure 5.55).

Figure 5.55 Use of TEEAL by postgraduate students



As shown in Figure 5.56 below, OARE and HIGHWIRE were the databases used least often. For HIGHWIRE, 87 of 118 (73.73%) respondents indicated that they had *never* used the database, while for OARE it was reported that 86 of 116 (74.14%) had *never* used the database.

Figure 5.56 Use of e-resources by postgraduate students



5.6.11 Types of use of e-resources by postgraduate students in STM

Table 5.64 below displays postgraduate students' opinion on the use of library e-resources in running current awareness or alerting services for their benefit, verifying bibliographic data and preparing research articles (Question 11, Appendix 4).

5.6.11.1 Running current awareness/alerting services

More than a third of respondents (42/113, 37.17%) stated that they *sometimes* used e-resources to run current awareness or alerting services for their own benefit, while almost a quarter (25/113, 22.12%) reported that they *often* used e-resources to run current awareness or alerting services for their own benefit. In combination, 40/113 (35.39%) used it *often* or *very often*.

5.6.11.2 Verifying bibliographic data

The results shown in Table 5.64 reflect that more than a third of postgraduate students (43/115, 37.39%) *sometimes* used e-resources to verify bibliographic detail, 34 of 115 (29.57%) *often* use e-resources to verify bibliographic detail and 21 of 115 (18.26) *very often* used e-resources to verify bibliographic data.

5.6.11.3 Preparing research articles

The majority of postgraduate students used e-resources to prepare articles. The results in Table 5.64 show that a quarter (28/112, 25%) of postgraduate students who took part in the study used e-resources to prepare articles s*ometimes* and 25 of 112 (22.32%) *often* used e-resources to prepare articles, while 24 of 112 (21.43%) *very often* used e-resources to prepare articles.

5.6.11.4 Preparing papers for conferences

Further, more than a third (40/110, 36.36%) of postgraduate students *never* used e-resources to prepare for conferences, 15 of 110 (13.64%) *almost never* used e-resources to prepare for conferences and 29 of 110 (14.55%) used e-resources for the purpose *sometimes*. In combination, 26 of 110 (23.64%) *often* or *very often* used e-resources to prepare papers for conferences.

5.6.11.5 Writing grant proposals

A third of postgraduate students (38/109, 34.86%) who took part in the study had *never* used e-resources to write grant proposals, while a quarter (27/109, 24.77%) had used them *sometimes.*

5.6.11.6 Other resources

More than half of the respondents investigated (20/35, 57.14%) contended that they never used e-resources for any other use than those mentioned, with six of 35 (17.14%) stating that they *almost never* used e-resources for any other use, while only three of 35 (8.57%) used e-resources for other purposes *sometimes.*

Table 5.64 Types of use of e-resources by postgraduate students in STM

Types of use of e-resources by postgraduate students	***N***	**Never**		**Almost never**		**Sometimes**		**Often**		**Very often**	
		F	%	F	%	F	%	F	%	F	%
To run current awareness or alerting services for their own benefit	113	22	19.47	9	7.96	42	37.17	25	22.12	15	13.27
To verify bibliographic detail	115	15	13.04	2	1.74	43	37.39	34	29.57	21	18.26
To prepare articles	112	29	25.89	6	5.36	28	25	25	22.32	24	21.43
To prepare papers for conferences	110	40	36.36	15	13.64	29	26.36	16	14.55	10	9.09
To write grant proposals	109	38	34.86	17	15.60	27	24.77	16	14.68	11	10.09
Other	35	20	57.14	6	17.14	3	8.57	4	11.43	2	5.71

5.6.12 Frequency of downloading full-text articles by students

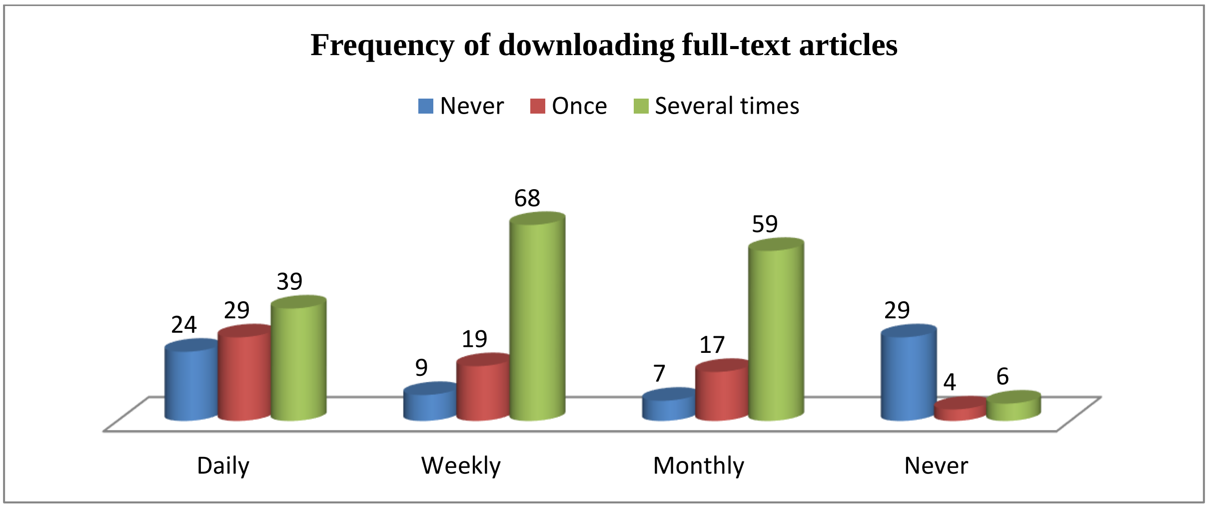
Table 5.65 and Figure 5.57 below present the results of an enquiry into the frequency of postgraduate students downloading full-text articles (Question 12, Appendix 4). Twenty-four of 92 respondents (26.09%) had never downloaded an article, 29 of 92 respondents (31.52%) had downloaded full-text articles once, while 39 of 92 respondents (42.39%) downloaded full articles several times a day.

Table 5.65 Frequency of downloading full-text articles by postgraduate students

Frequency of downloading full-text articles from e-resources	***N***	**Never**		**Once**		**Several times**	
		F	%	F	%	F	%
Daily	92	24	26.09	29	31.52	39	42.39
Weekly	96	9	9.38	19	19.79	68	70.38
Monthly	83	7	8.43	17	20.48	59	71.08
Never	39	29	74.36	4	10.26	6	15.38

The findings depicted in Figure 5.57 also show that 9 of 96 postgraduate students (9.38%) never downloaded full articles, 19 of 96 respondents (19.79%) downloaded full articles once a week, and 68 of 96 (70.83%) downloaded full-text articles several times weekly. Almost three quarters (59/83, 71.08%) of postgraduate students downloaded full- text articles several times a month. Interestingly, the results also revealed that a majority of postgraduate students (29/39, 74.36%) had never downloaded full-text articles.

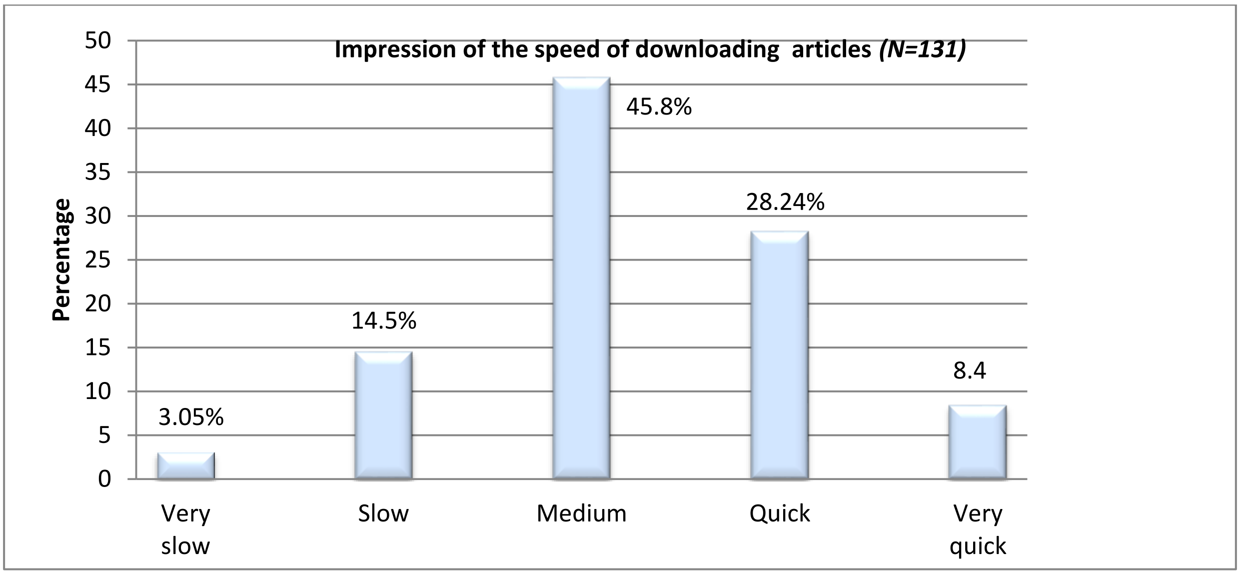
Figure 5.57 Frequency of downloading full-text articles by postgraduate students



5.6.13 Speed of downloading articles from the internet at the universities

Postgraduate students' impression of the average speed of downloading an article from the internet at their respective universities was investigated (Question 13, Appendix 4). Almost half of the respondents (60/131, 45.8%) reported that the internet speed was *medium*, while 11 of 131 (8.4%) indicated that the internet speed of downloading an article was *very quick*. The results are displayed in Figure 5.58 below.

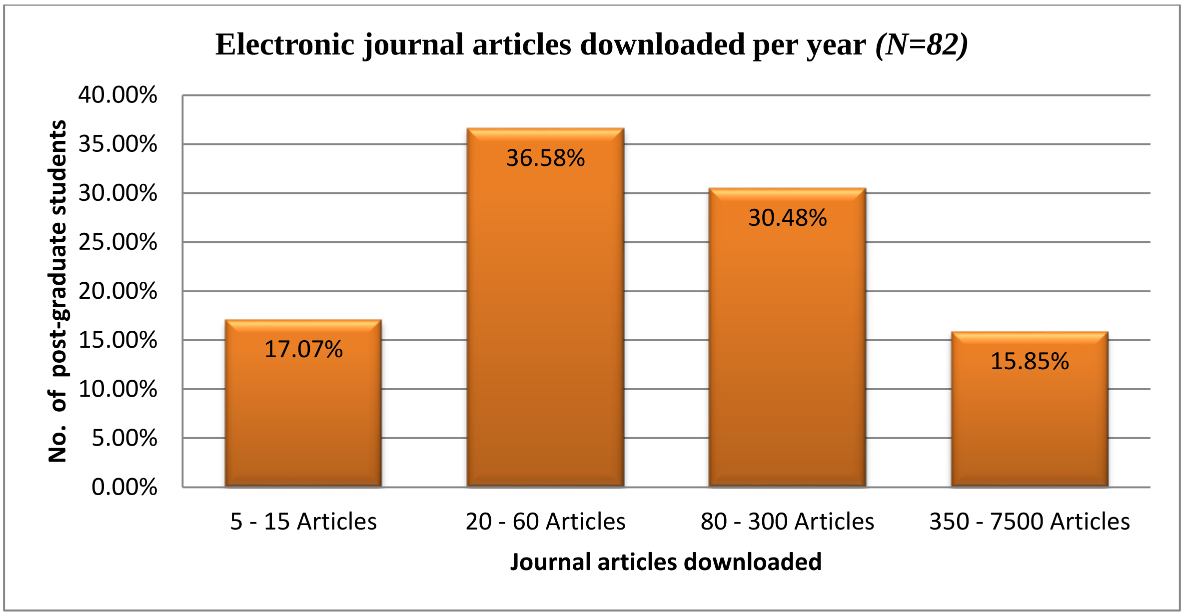
Figure 5.58 Average speed of downloading full-text articles



5.6.14 E-journal articles downloaded per year

The number of journal articles downloaded per year by postgraduate students was investigated (Question 14, Appendix 4). Figure 5.59 below shows that more than a third of the respondents (30/82, 36.58%) had downloaded between 20 and 60 articles a year, while only 13 of the 82 respondents (15.85%) had downloaded between 350 and 7 500 articles a year. The figure intervals were designed to cover the wide varience between the institutions.

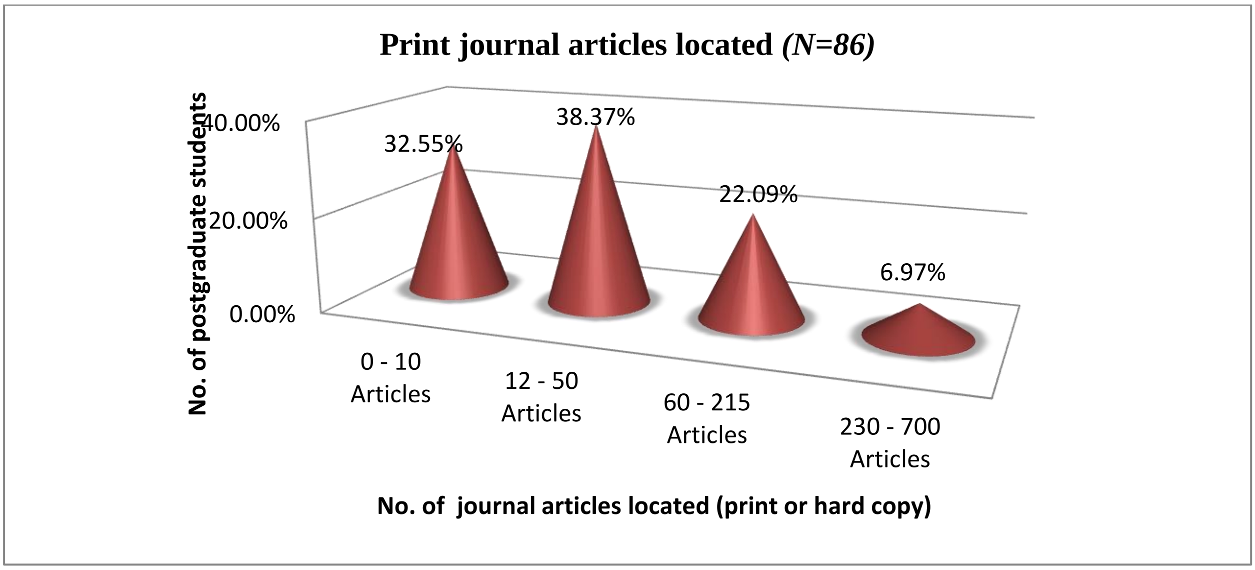
Figure 5.59 E-journal articles downloaded per year



5.6.15 Print journal articles located

An investigation into the number of journal articles that postgraduate students located in print or hard copy (Question 15, Appendix 4) revealed that more than a third of the respondents (33/86, 38.37%) located 12-50 articles in print or hard copy, while 6 of the 86 respondents (6.97%) located 230-700 articles. The results are shown in Figure 5.60 below. The figure intervals were designed to cover the wide varience between the institutions.

Figure 5.60 Electronic journal articles located (print or hard copy)



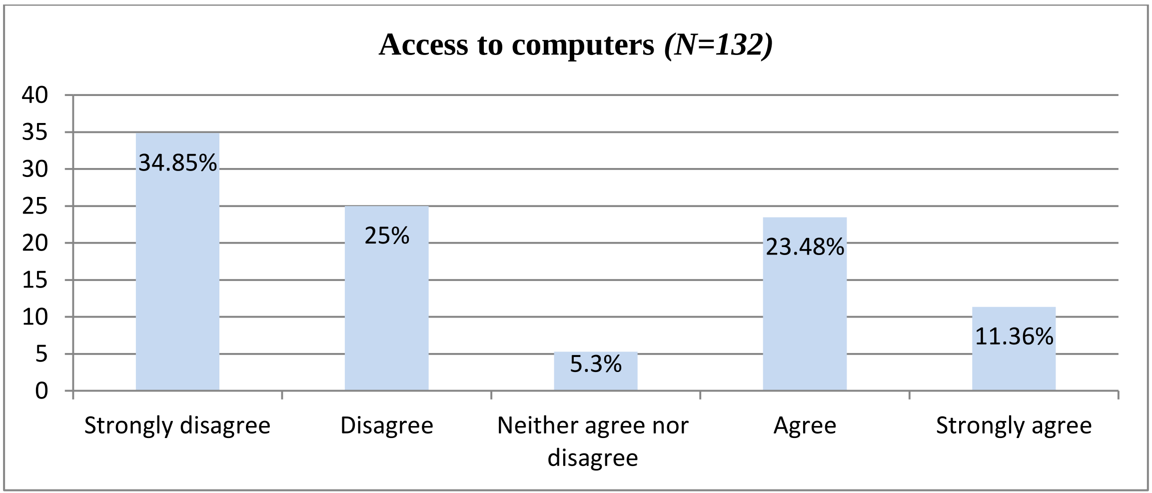
5.6.16 Factors that influence non-use of e-resources by postgraduate students

Results from an investigation into how the postgraduate students' rated several factors that influence them not to use e-resources are presented in the following sub-sections (Question 16, Appendix 4). Although respondents were expected to respond to all options, often they did not. Therefore N differs, and is indicated in the table per option.

5.6.16.1 Lack of access to computers

The perception of postgraduate students of the factors that influence non-use of resources was sought. The findings presented in Figure 5.61 below reveal that more than a third of the respondents (46/132, 34.85%) *strongly disagreed* that lack of access to computers contributed to non-use of e-resources, a quarter of them (33/132, 25%) *disagreed*, while seven of the 132 respondents (5.3%) *neither agreed nor disagreed* that lack of access to computers was a problem.

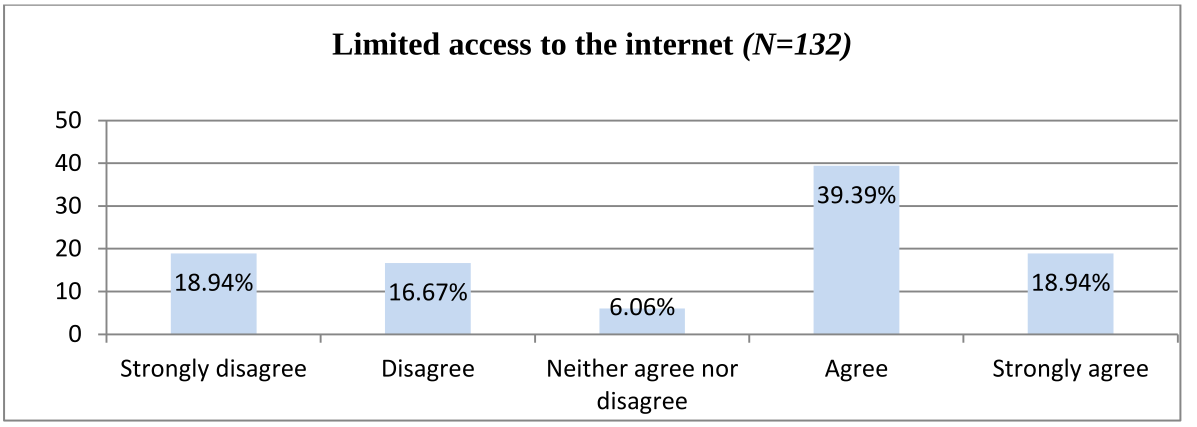
Figure 5.61 Lack of access to computers by postgraduate students



5.6.16.2 Limited access to the internet

Some postgraduate students reported that some e-resources were not used due to limited access to the internet. Figure 5.62 below show that more than half of the respondents (52/132, 39.39%) *agreed* with the sentiment, while 25 of 132 (18.94%) *strongly agreed* that limited access to the internet influenced non use of e-resources. In combination, 77 of 132 (58.33%) respondents *agreed* or *strongly agreed* with the sentiment.

Figure 5.62 Limited access to the internet



5.6.16.3 Unreliable or slow internet access

Figure 5.63 below shows that more than half of the respondents (64/134, 47.76%) *agreed* that unreliable or slow internet access led to non-use of e-resources, while 37 of 134 of respondents (27.61%) *strongly agreed* that unreliable or slow internet access led to non-use of resources. In combination, 101 of 134 (75.37%) postgraduate respondents *agreed* or *strongly agreed* with the notion.

Figure 5.63 Unreliable or slow internet access

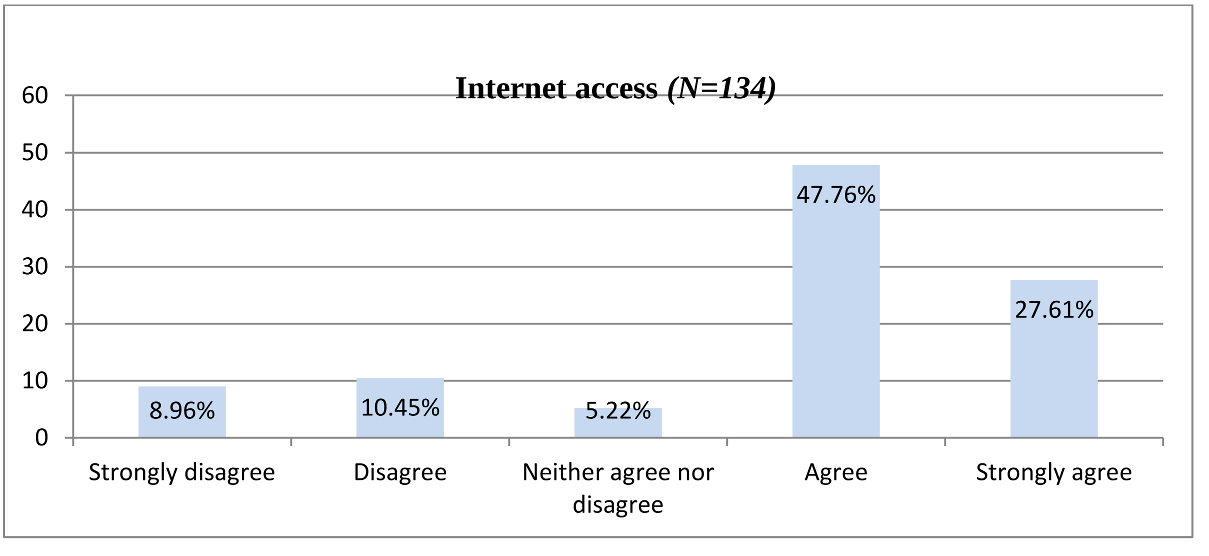


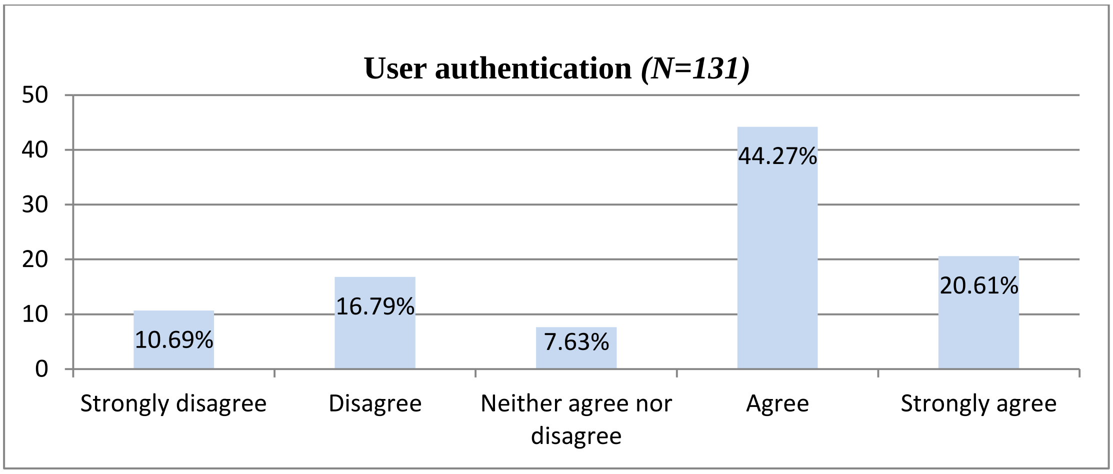
Table 5.66 Factors that influence non-use of e-resources by postgraduate students

Factors influencing non-use of e-resources by postgraduate students	***N***	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
Lack of access to computers	132	46	34.85	33	25	7	5.3	31	23.48	15	11.36
Limited access to the internet (e.g. because of high cost of internet access)	132	25	18.94	22	16.67	8	6.06	52	39.39	25	18.94
Unreliable or slow internet access	134	12	8.96	14	10.45	7	5.22	64	47.76	37	27.61
User authentication e.g. login ID or password	131	14	10.69	22	16.79	10	7.63	58	44.27	27	20.61
Unavailability of electronic full text articles	130	17	13.08	21	16.15	11	8.46	55	42.31	26	20
Too many steps required before getting a full-text article	131	13	9.92	16	12.21	20	15.27	56	42.75	26	19.85
Lack of skills to use e-resources	130	24	18.46	32	24.62	12	9.23	50	38.46	12	9.23
Lack of technical support to solve access problems with e-resources	129	16	12.4	23	17.83	17	13.18	47	36.43	26	20.16
Language of publications, i.e. mostly English	132	49	37.12	51	38.64	12	9.09	14	10.61	6	4.55
Lack of time to search e-resources	132	27	20.45	56	42.42	13	9.85	28	21.21	8	6.06

5.6.16.4 User authentication e.g. login ID or password to Research4Life programmes

Figure 5.64 below shows that almost half of the respondents (58/131, 44.27%) *agreed*, while almost a quarter of them (27/131, 20.61%) *strongly agreed*, that user authentication (e.g. login ID or password to Research4Life programmes (AGORA, HINARI, OARE, ARDI) hindered access to e-resources. In combination, 85 of 131 (64.88%) *agreed* or *strongly agreed* with the statement.

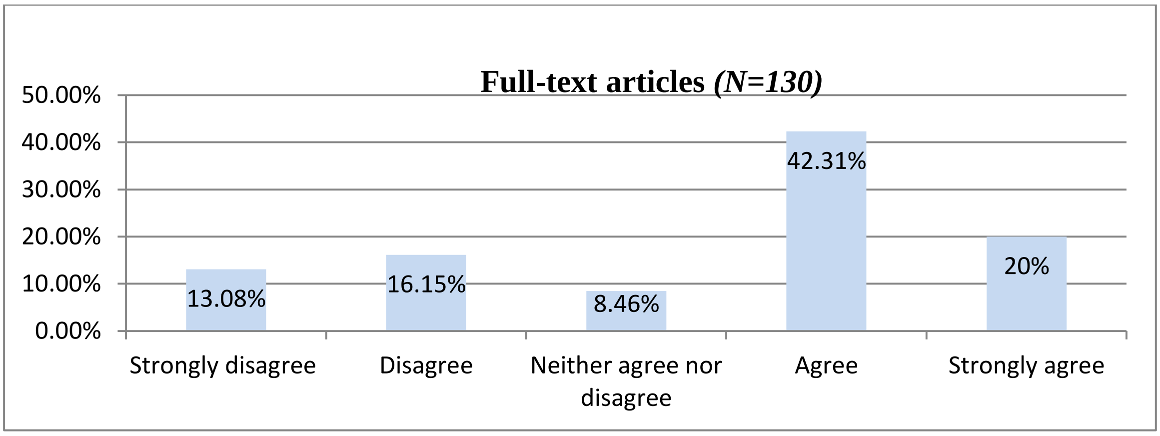
Figure 5.64 User authentication e.g. login ID or password to Research4Life



5.5.16.5 Unavailability of full-text articles

On investigating the non-use of e-resources due to the unavailability of full-text articles, the perception of participants in the study was explored. The results (Figure 5.65) showed that the majority of the postgraduate respondents (81/130, 62.31%) *agreed* or *strongly agreed* with the notion that the unavailability of full-text articles led to non-use of e-resources.

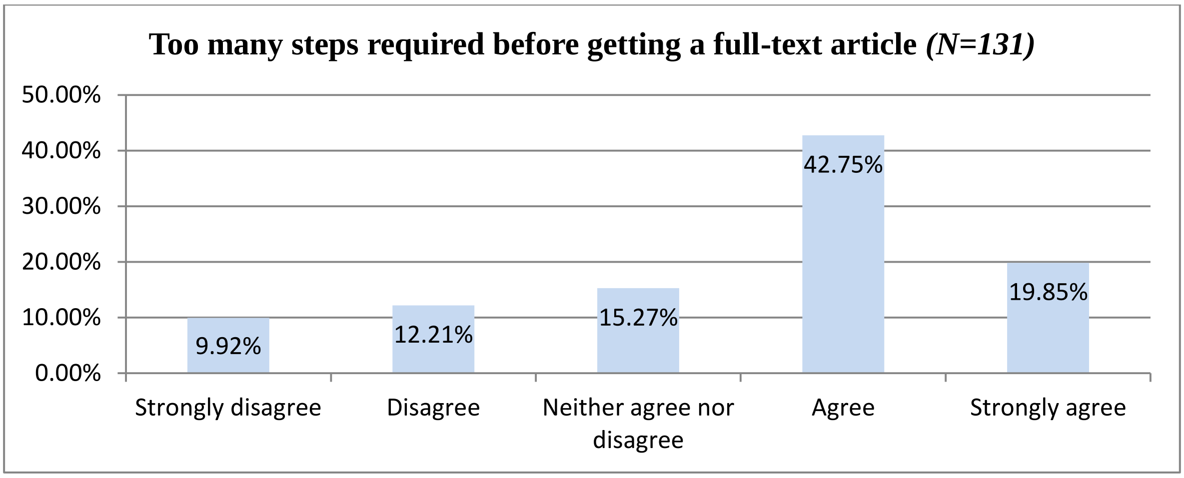
Figure 5.65 Unavailability of full-text articles



5.6.16.6 Too many steps required before getting a full-text article

Another factor influencing the non-use of e-resources was that too many steps are required before getting a full-text article. The perception of postgraduate students of this factor was investigated. The results (Figure 5.66, below) showed that more than a third of the respondents (56/131, 42.75%) *agreed,* while 26 of 131 (19.85%) postgraduate students *strongly disagreed* that too many steps were required before getting a full-text article. In combination, 82 of 131 (62.6%) respondents *agreed* or *strongly agreed* with the sentiment.

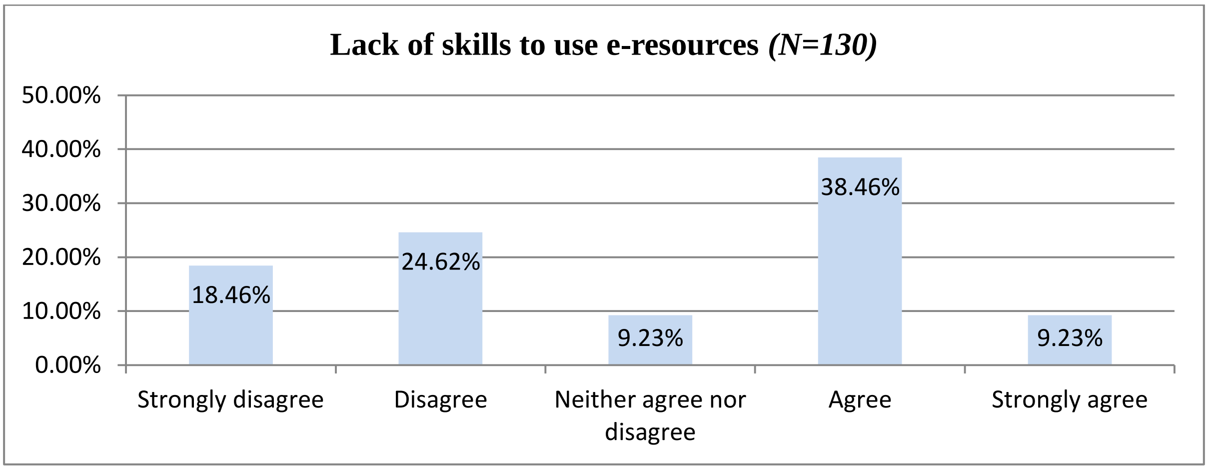
Figure 5.66 Too many steps required before getting a full-text article



5.6.16.7 Lack of skills to use e-resources by postgraduate students

In examining the perception of postgraduate students on lack of skills to use e-resources as a factor influencing non-use of resources, the following perceptions became evident from the results. More than a third of the respondents (50/130, 38.46%) *agreed*, with 12 of 130 (9.23%) postgraduate students *strongly agreeing* that lack of skills was a driver in non-use of e-resources. In combination, 47.69% respondents *agreed* or *strongly agreed* with the notion. Figure 5.67 below shows the results.

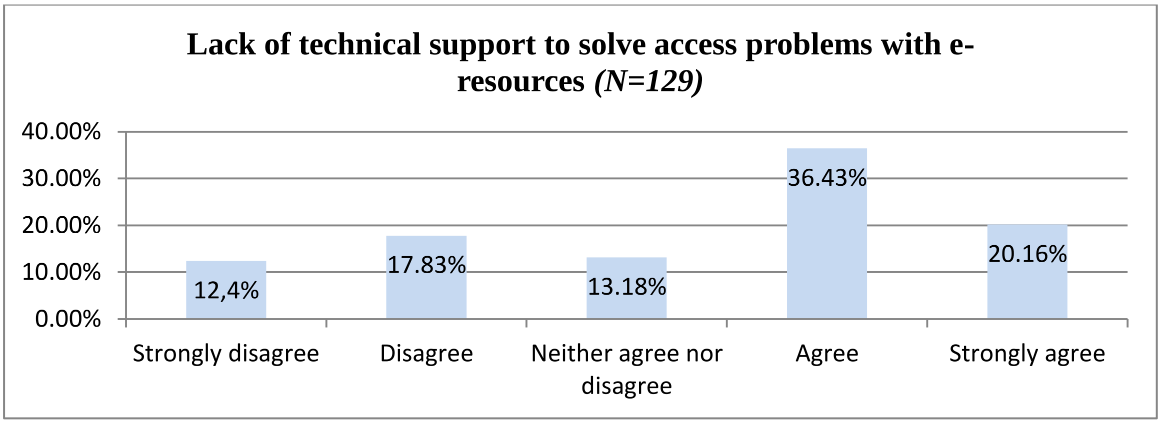
Figure 5.67 Lack of skills to use e-resources by postgraduate students



5.6.16.8 Lack of technical support to solve access problems with e-resources

Lack of technical support to solve access problems with available e-resources was another factor cited as influencing the non-use of e-resources. More than a third of the respondents (47/129, 36.43%) *agreed* with the notion, while 16 of 129 (12.4%) *strongly disagreed* that lack of technical support to solve access problems with available e-resources influenced the non-use of e-resources. In combination, 56.59% *agreed* or *strongly agreed* with the statement. Figure 5.68 below show the results.

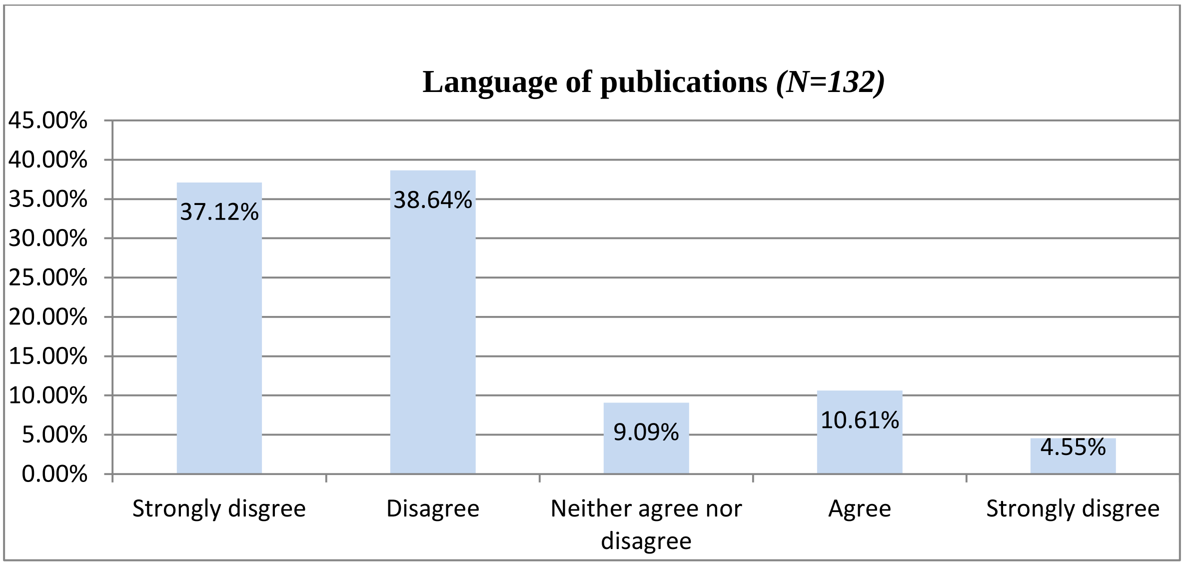
Figure 5.68 Lack of technical support to solve access problems



5.6.16.9 Language of publications

The perception of postgraduate students of the language of publications, i.e. mostly English, influencing the non-use of e-resources was investigated. In the response 49 of 132 respondents (37.12%) *strongly disagreed*, while 51 of 132 (38.64%) *disagreed.* Figure 5.69 below show the results. In combination, 75.76% respondents *disagreed* or *strongly disagreed* with the sentiment.

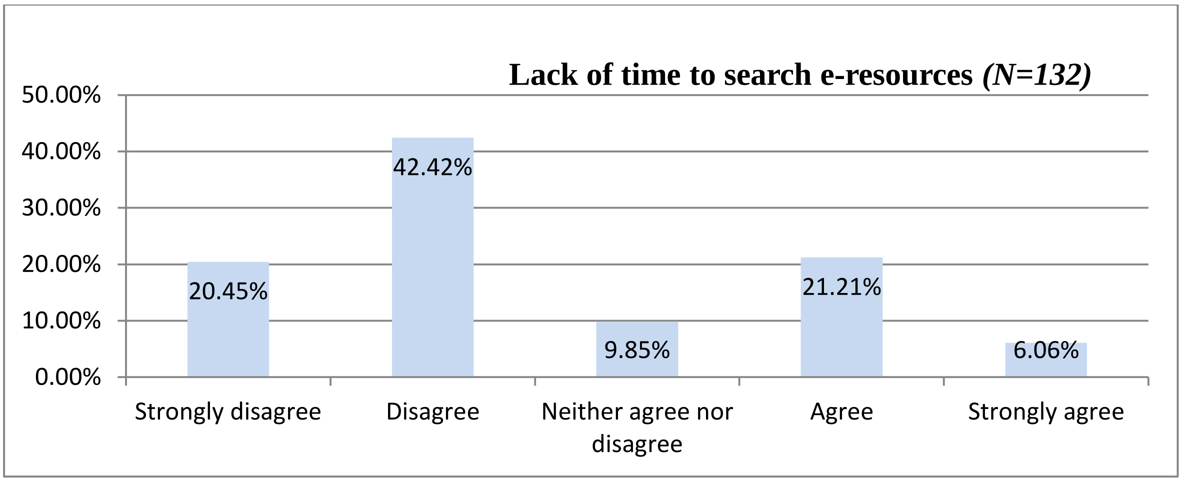
Figure 5.69 Language of publications



5.6.16.10 Lack of time to search e-resources

Almost half of the postgraduate students (56/132, 42.42%) *disagreed*, while 8 of 132 (6.06%) *strongly agreed* that lack of time to search e-resources led to non-use of e-resources. In combination, 62.87% respondents disagreed or strongly disagreed with the notion. Figure 5.70 below show the results.

Figure 5.70 Lack of time to search e-resources by postgraduate students



5.6.17 Factors that influence use of e-resources by postgraduate students

The graduate students were asked to rate the impact of factors that influence use of e-resources such as the ease of use of e-resources, their ability to search databases, training on use of e-resources, their experience in the use of e-resources and the impact of the cost of internet. (Question 17, Appendix 4). Table 5.67, below presents the results. Although respondents were expected to respond to all options, often they did not. Therefore N differs, and is indicated in the table per option. The results are detailed in the following sections.

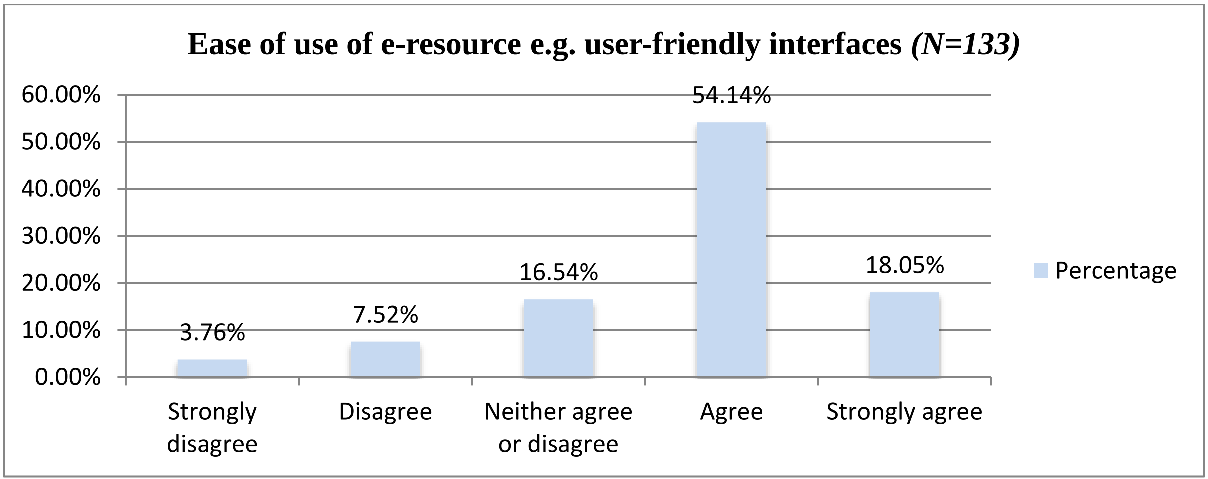
Table 5.67 Factors that influence use of e-resources by postgraduate students

Factors influencing use of e-resources	***N***	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
Ease of use of e-resource, e.g. user-friendly interfaces	133	5	3.76	10	7.52	22	16.54	72	54.14	24	18.05
Good search skills	133	1	0.75	8	6.02	12	9.02	87	65.41	25	18.80
Training in using e-resources	130	8	6.15	17	13.08	16	12.31	67	51.54	22	16.92
Experience in using e-resources	132	3	2.27	14	10.61	15	11.32	75	56.82	25	18.94
Good technical support when one encounters problems with the resources	129	7	5.43	23	17.83	24	18.60	52	40.31	23	17.83
Increases in quality research output required by the university	132	10	7.58	3	2.27	18	13.64	74	56.06	27	20.45
Low cost of internet access	133	21	15.79	18	13.53	20	15.04	43	32.33	31	23.31

5.6.17.1 Ease of use of e-resources

The perception of postgraduate students in STM was ascertained on the ease of use of e-resources, e.g. user-friendly interfaces. More than half (72/133, 54.14%) of postgraduate students *agreed*, while 24 of 133 (18.05%) postgraduate students *strongly agreed*, that the ease of use of e-resources, e.g. user-friendly interfaces, allowed for the use of e-resources. In combination, 96 of 133 (72.19%) respondents *agreed* or *strongly agreed* with the notion. Refer to Figure 5.71.

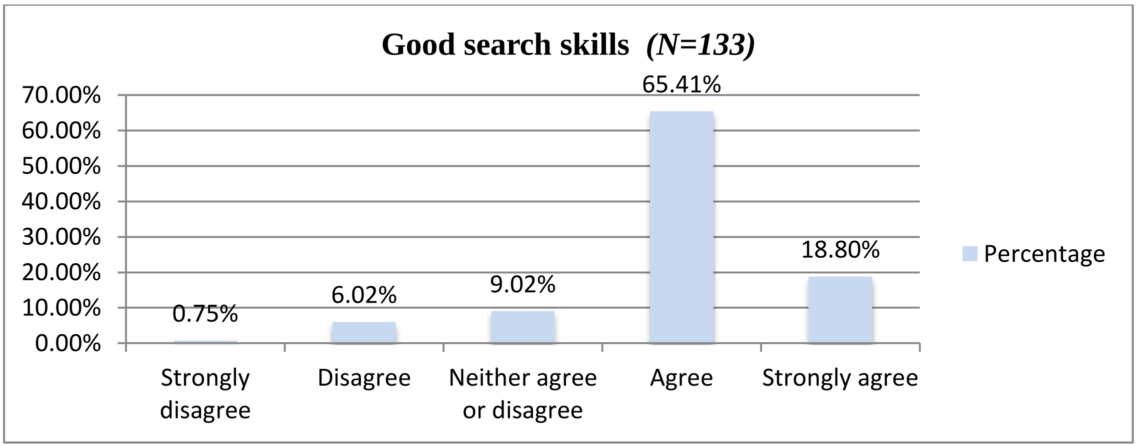
Figure 5.71 Ease of use of e-resource



5.6.17.2 Good searching skills

Figure 5.72 illustrates good searching skills as one of the reasons enabling use of e-resources. In an investigation on the perception of postgraduate students of this factor, a majority of the respondents (87/133, 65.41%) *agreed* with the notion, while 25 of 133 (18.8%) *strongly agreed* that good searching skills enabled use of e-resources. In combination, 112 of 133 (84.21%) respondents agreed with the sentiment.

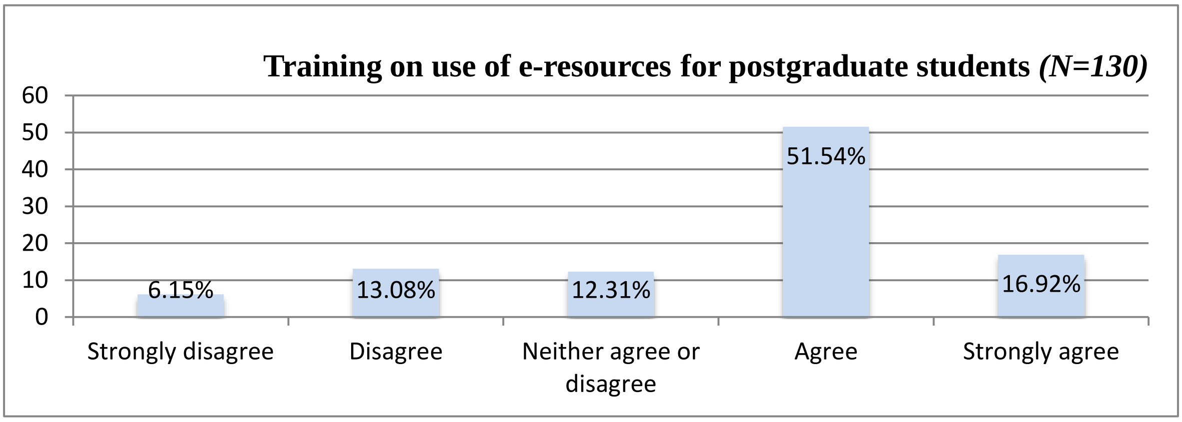
Figure 5.72 Good searching skills by postgraduate students



5.6.17.3 Impact of training on e-resources for postgraduate students

The results recorded revealed that about half of the respondents (67/130, 51.54%) *agreed*, while 22 of 130 (16.92%) postgraduate students *strongly agreed* that training influenced the use of e-resources by postgraduate students. Refer to Figure 5.73.

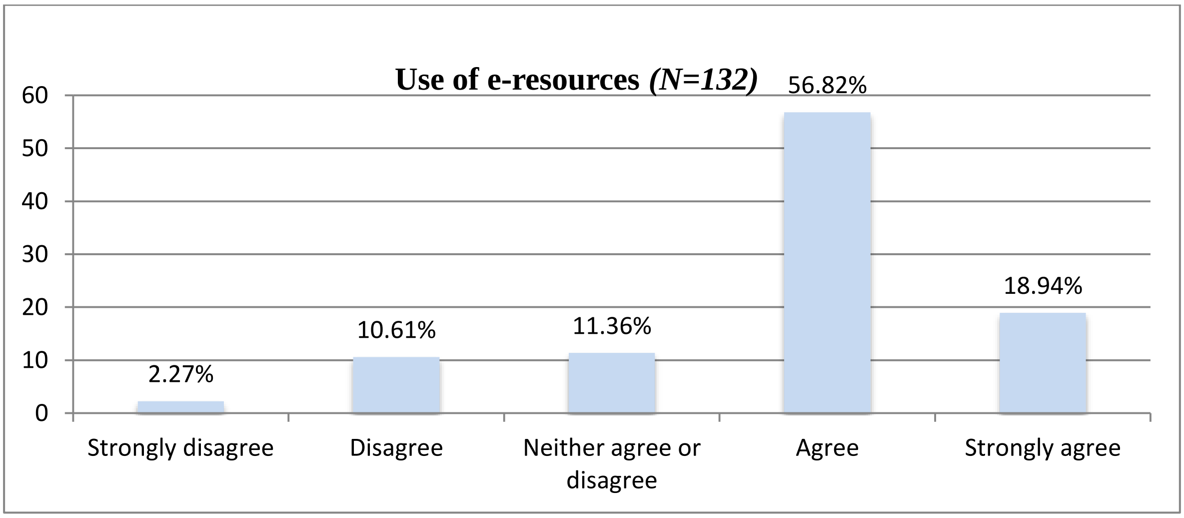
Figure 5.73 Training on use of e-resources



5.6.17.4 Experience in using e-resources

Experience in using e-resources has also proven to be an important factor in enabling use of e-resources. On exploring the perceptions of postgraduate students of this view, more than half of the respondents (75/132, 56.82%) *agreed*, while three of 132 (2.27%) postgraduate *students disagreed* that experience enabled the use of e-resources. Figure 5.74 below show the results. In combination, 100 of 132 (75.76%) postgraduate respondents *agreed* or *strongly agreed* with the statement.

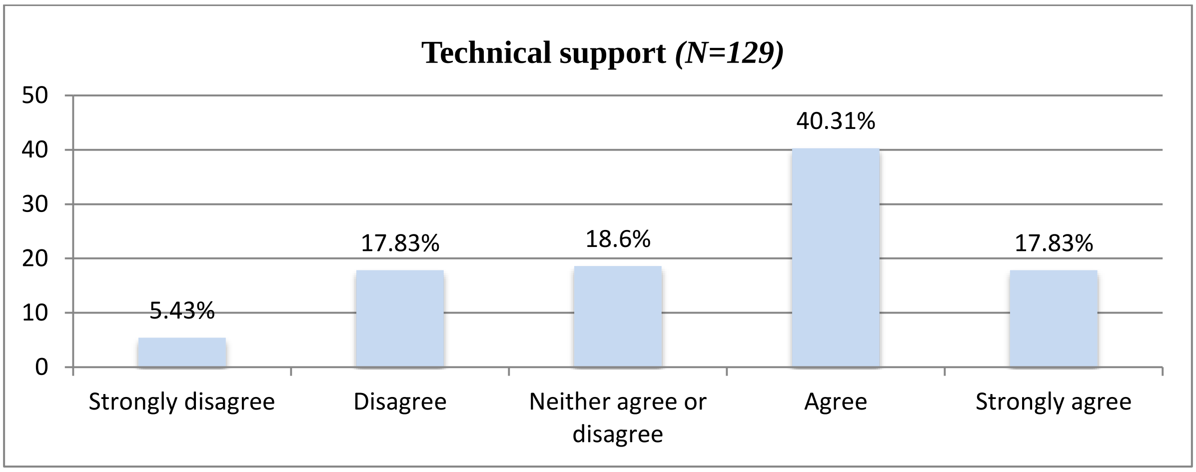
Figure 5.74 Experience in using e-resources by postgraduate students



5.6.17.5 Good technical support

The need for good technical support when encountering problems with e-resources was investigated. Postgraduate students' responses revealed that seven of 129 (5.43%) *strongly disagreed,* while more than a third (52/129, 40.31%) *agreed* that good technical support is required when encountering problems with e-resources. In combination, 58.14% *agreed* or *strongly agreed* with the statement. Figure 5.75 below show the results.

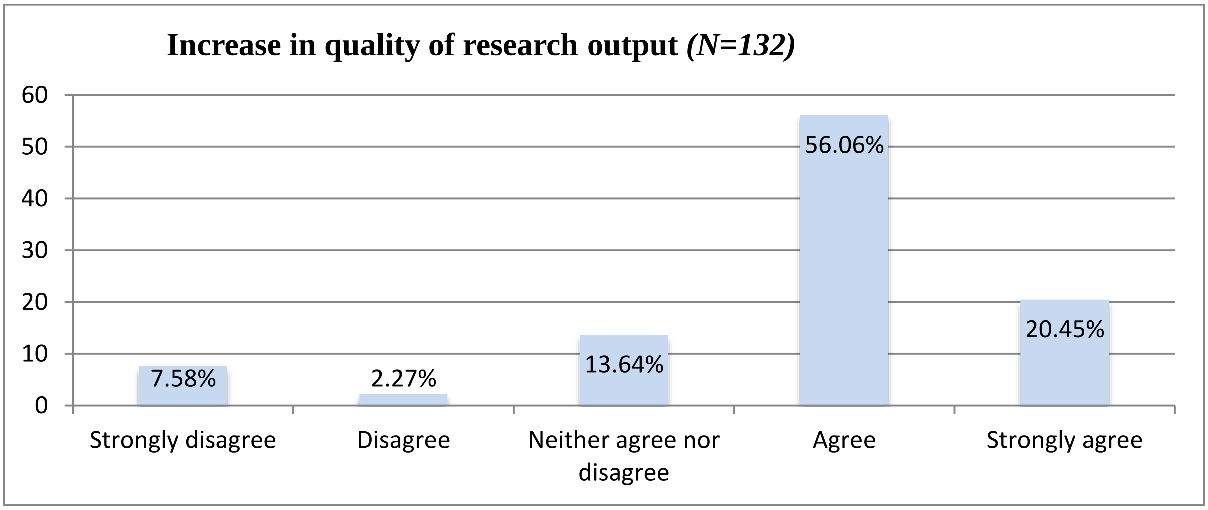
Figure 5.75 Good technical support



5.6.17.6 Quality research output

In a drive to increase quality research output, institutions motivate their staff to engage in research activities, thus increasing the use of e-resources. More than half (74/132, 56.06%) of the respondents *agreed*, while 27 of 132 (20.45%) *strongly agreed* that quality research output required by universities motivate their staff to engage in research activities. In combination, 76,51% of the respondents *agreed* or *strongly agreed* with the notion. Figure 5.76 show the results.

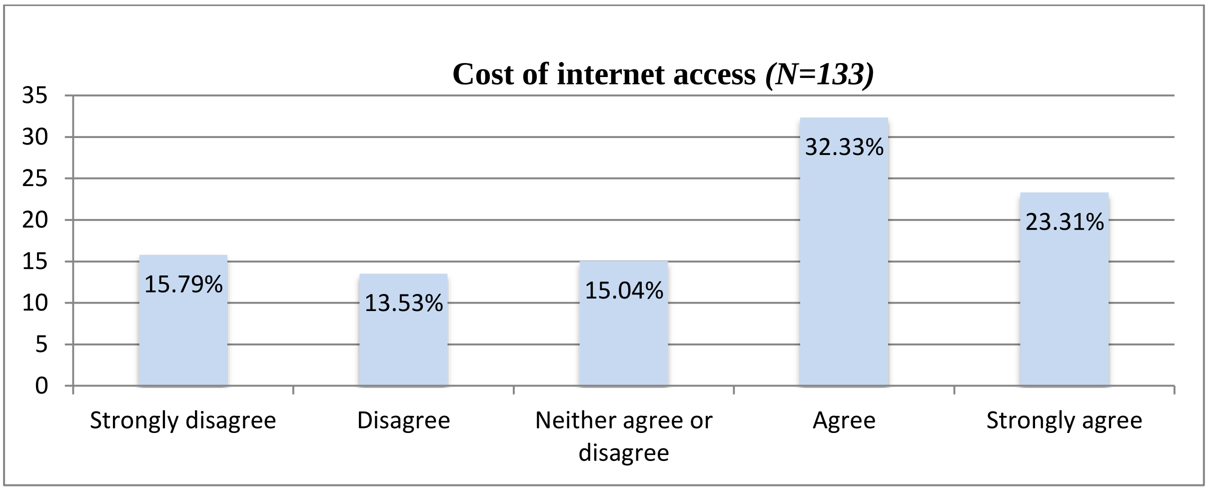
Figure 5.76 Increase in quality research output



5.6.17.7 Low cost of internet access increasing use of e-resources

Low cost of internet access also led to increased use of e-resources. A third of postgraduate students (43/133, 32.33%) *agreed* with this view, while almost a quarter (31/133, 23.31%) *strongly agreed* that the low cost of internet access led to increased use of e-resources. In combination, 55.64% repondents *agreed* or *strongly agreed* with the notion. Figure 5.77 show the results.

Figure 5.77 Low cost of internet increasing use of e-resources



5.6.18 Level of libraries e-resources meeting postgraduate students' needs

Question 18 (Appendix 4) asked postgraduate students to indicate how well the e-resources provided by their library met their needs in terms of several factors indicated in Table 5.68. N differs per factor, and is indicated in the table (5.68).

Table 5.68 Perception of postgraduate students on how well university libraries met their e-resources needs

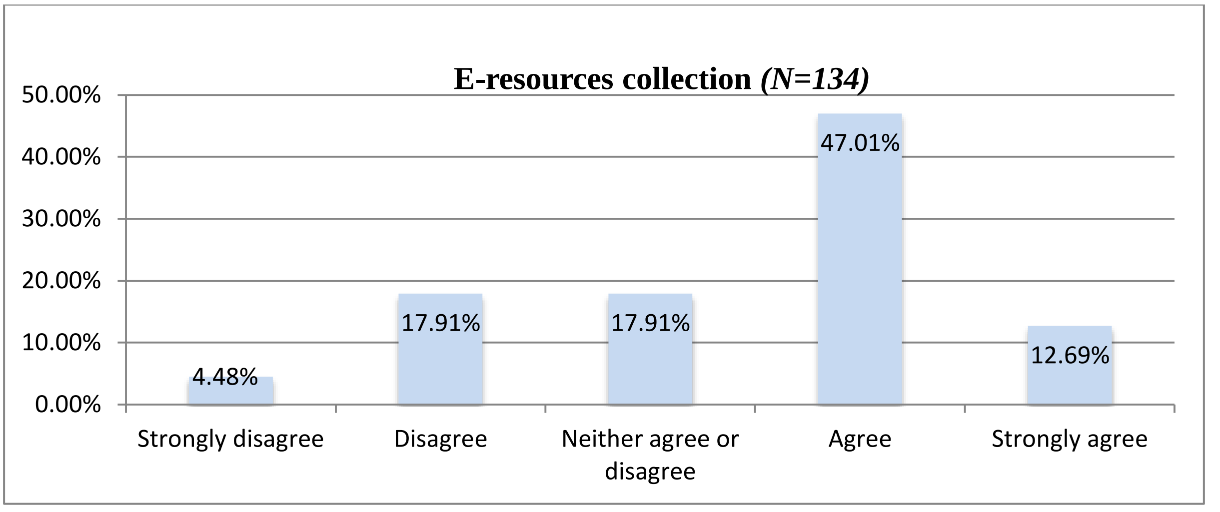
Perception of postgraduate students on libraries	***N***	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
Type of materials covered	134	6	4.48	24	17.91	24	17.91	63	47.01	17	12.69
Scope of topics covered	134	6	4.48	21	15.67	21	15.67	67	50	19	14.18
Currency of materials (e.g. are resources up to date)	134	14	10.45	25	18.66	24	17.91	50	37.31	21	15.67
Availability of full-text	133	11	8.27	28	21.05	20	15.04	61	45.86	13	9.77
Relevance to research objectives	133	10	7.52	9	6.77	23	17.29	71	53.38	20	15.04
Ease of access to full-text	132	15	11.36	29	21.97	24	18.18	47	35.61	17	12.88

The following sections, 5.6.18.1 to 5.6.18.6 explain findings in detail per factor.

5.6.18.1 Type of materials covered

An investigation was conducted to ascertain postgraduate students' perception of the factors that influence the use of e-resources. Almost half of the respondents (63/134, 47.01%) *agreed* that the type of materials covered in e-resources met their needs, while 17 of 134 (12.69%) students *strongly agreed* that the type of materials covered in e-resources met their research needs. In comination, 80 of 134 (59.7%) postgraduate respondents indicated that they *agreed* or *strongly agreed* with the notion. Figure 5.78 show the results.

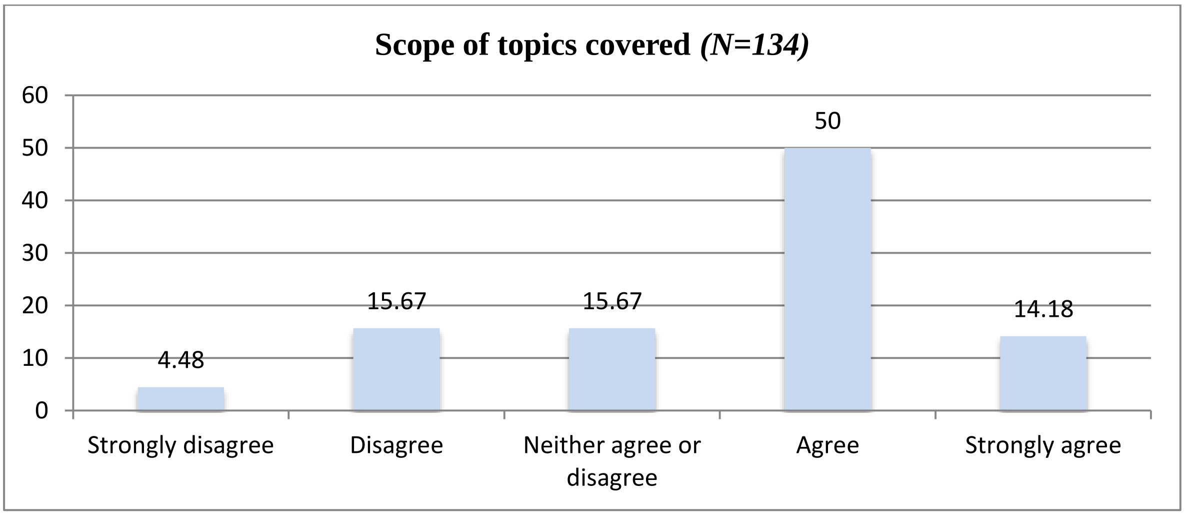
Figure 5.78 Type of materials covered



5.6.18.2 Scope of topics covered

Half of the postgraduate students (67/134, 50%) in the study stated that the scope of topics covered by the e-resources met their needs, while 19 of 134 (14.18%) *strongly agreed*. In combination, 64.18% respondents *agreed* or *strongly agreed* with the sentiment. Figure 5.79 show the results.

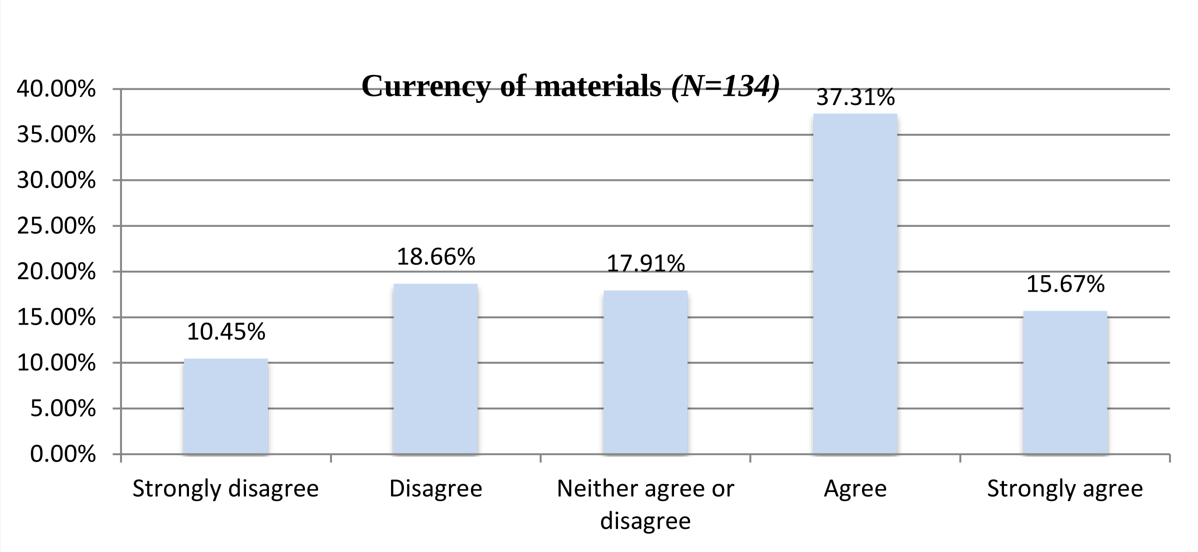
Figure 5.79 Scope of topics covered



5.6.18.3 The currency of materials

The currency of materials (e.g. whether resources are up to date) was examined. More than a third of the respondents (67/134, 37.31%) *agreed* that the currency of materials was satisfactory, while 21 of 134 (15.67%) *strongly agreed* that the currency of materials was adequate. In combination, 88 of 134 (52.98%) postgraduate respondents *agreed* or *strongly agreed* with the sentiment. Refer to Figure 5.80.

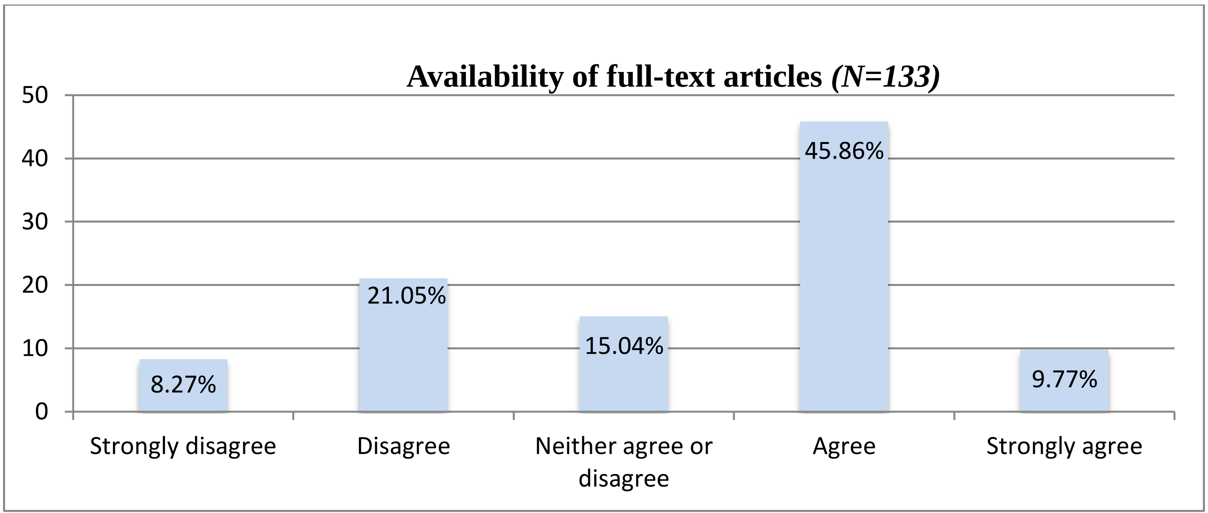
Figure 5.80 Currency of materials



5.6.18.4 Availability of full-text articles

The availability of full-text articles also allows for the use of e-resources. Almost half the respondents (61/133, 45.86%) *agreed* that the availability of full-text articles met their needs, while 13 of 133 (9.77%) postgraduate students *strongly agreed* with this view. Figure 5.81 show the results.

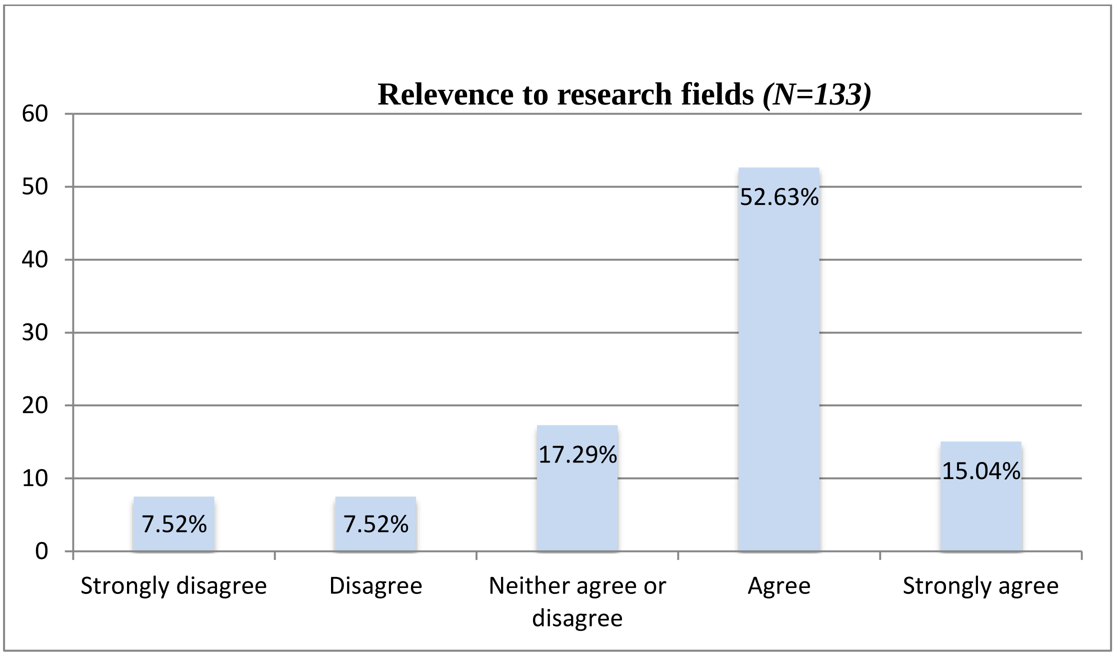
Figure 5.81 Availability of full-text articles



5.6.18.5 Relevance to research objectives

More than half of the postgraduate students investigated (71/133, 53.38%) *agreed* that e-resources at their disposal were relevant to their research objectives, while nine of 133 (6.77%) *disagreed* with this statement. In combination, (91/133, 68.42%), *agreed* or *strongly agreed* with the notion. Figure 5.82 show the results.

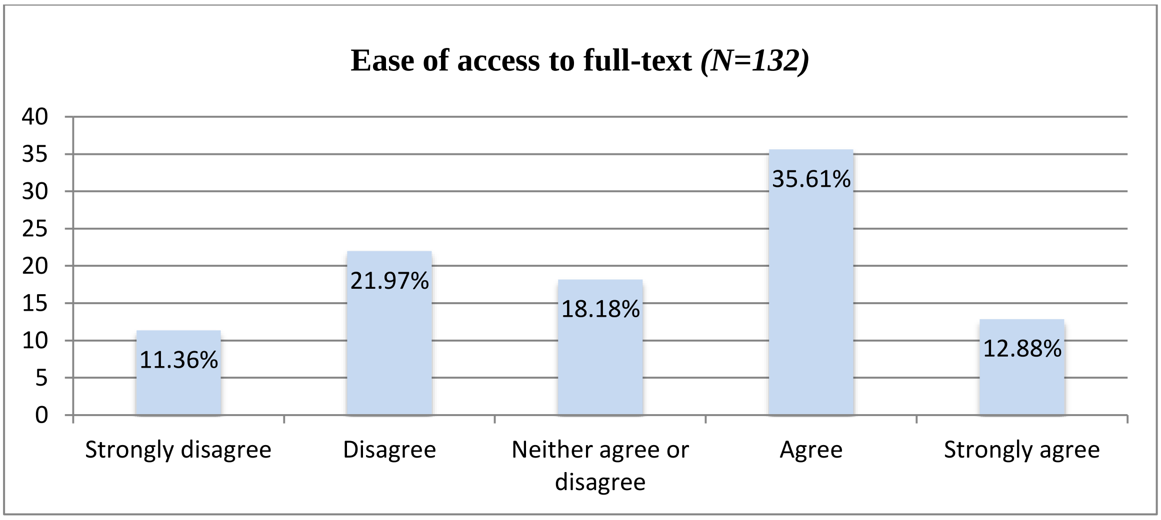
Figure 5.82 Relevance to research objectives for postgraduate students



5.6.18.6 Ease of access to full-text articles

Ease of access to full-text articles allows postgraduate students to meet their research needs. More than a third of respondents (47/132, 35.61%) *agreed* that ease of access to full-text articles allowed them to fulfil their research duties, while 17 of 132 (12.88%) *strongly agreed* with this view. Figure 5.83 show the results.

Figure 5.83 Ease of access to full-text e-resources



5.6.19 Use of e-resources for research purposes by postgraduate students

Table 5.69 below presents the results when postgraduate students were asked if they would be more likely to use e-resources for research purposes if they had more knowledge about the available resources, they had more training, better access to databases they needed, had a more stable electricity supply at the institutions, better internet access, no restrictions on internet access at the institution and internet connectivity from home was cheaper (Question 19, Appendix 4).

Although the students were expected to respond to all factors, N differs per factor and is indicated in the table. The results are discussed in detail in the following sub-sections.

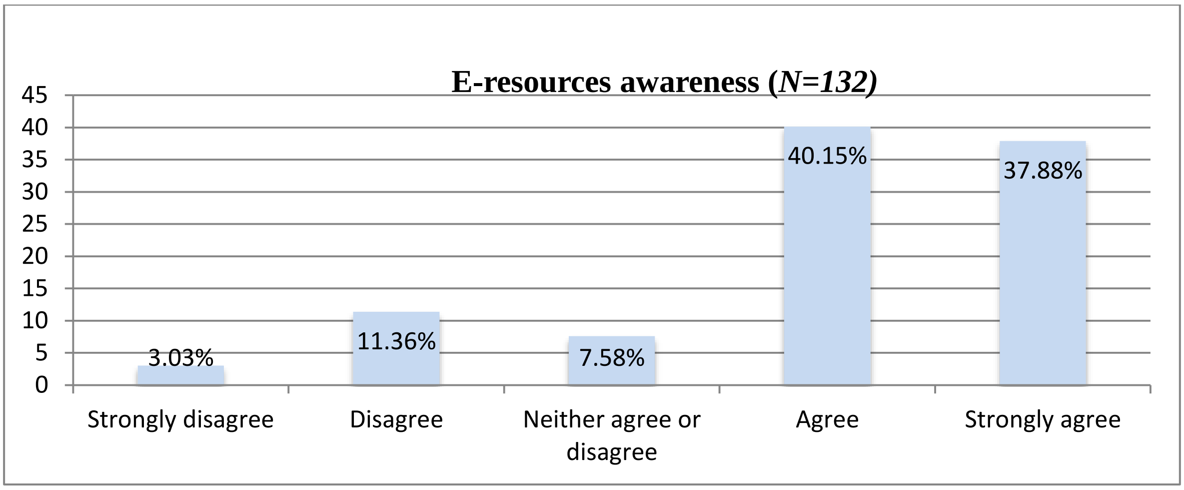
Table 5.69 E-resources' use for research purposes by postgraduate students

Postgraduate students' perception on use of e-resources for research purposes	***N***	**Strongly disagree**		**Disagree**		**Neither agree nor disagree**		**Agree**		**Strongly agree**	
		F	%	F	%	F	%	F	%	F	%
I had more knowledge about e-resources availability at my institution	132	4	3.03	15	11.36	10	7.58	53	40.15	50	37.88
My library would train me on using e-resources	134	8	5.97	9	6.72	16	11.94	57	42.54	44	32.84
I had better access to databases that I need at my institution	133	8	6.02	8	6.02	18	13.53	58	43.61	41	30.83
Electricity supply was more stable at my institution	132	22	16.67	18	13.64	17	12.88	48	36.36	27	20.45
I had stable internet access at my institution	130	13	10	13	10	11	8.46	52	40	41	31.54
There was no restriction on internet access at the institution	133	22	16.54	18	13.53	13	9.77	46	34.59	34	25.56
Internet connectivity from home was cheaper	133	18	13.53	10	7.52	7	5.26	52	39.10	46	34.59

5.6.19.1 Knowledge about the available e-resources

The perception of postgraduate students of their use of e-resources for research purposes was sought. The findings revealed that 53 of 132 (40.15%) of postgraduate students *agreed* that they would make more use of e-resources if they had better knowledge, with more than a third (50/132, 37.88%) strongly agreed supporting this statement. The results are displayed below (Figure 5.84)

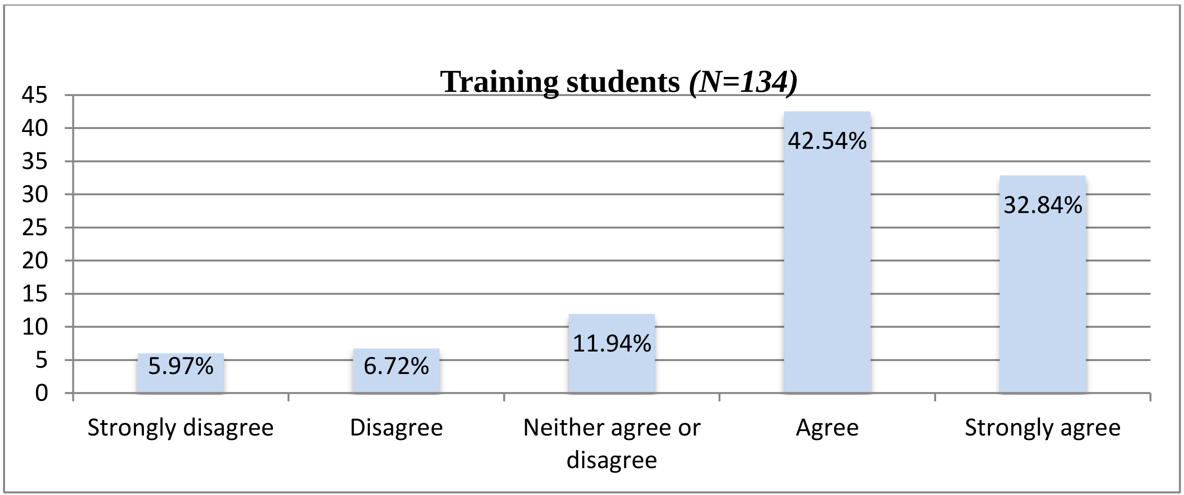
Figure 5.84 Knowledge about e-resources available at institutions



5.6.19.2 Training of students by the library

Figure 5.85 shows that almost half (57/134, 42.54%) of the postgraduate students surveyed *agreed* that they would use e-resources for research purposes if libraries in their institutions would train them, with a further third (44/134, 32.84%) of the students *strongly agreeing* that they would use e-resources for research purposes if the libraries would train them.

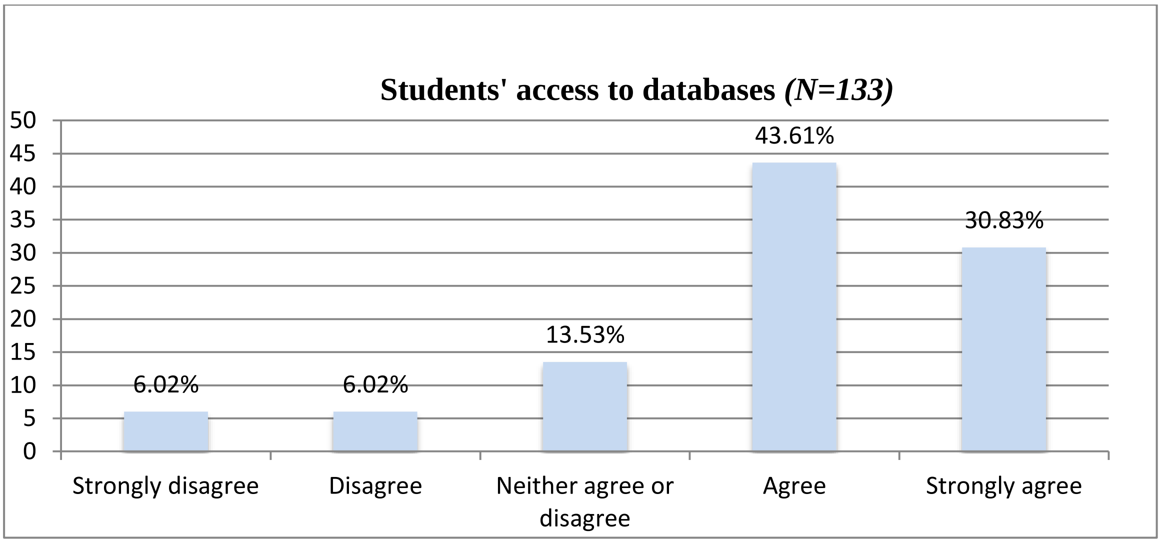
Figure 5.85 Training of students by the library



5.6.19.3 Access to databases

As depicted in Figure 5.86 below, having better access to databases that allow for the use of e-resources for research purposes would prove important to postgraduate students. More than a third (58/133, 43.61%) *agreed*, while eight of 133 (6.02%) postgraduate students *strongly disagreed* that having better access to databases that allow for use of e-resources for research purposes would prove important to postgraduate students. In combination, 99 of 133 (74.44%) respondents *agreed* or *agreed strongly* with it.

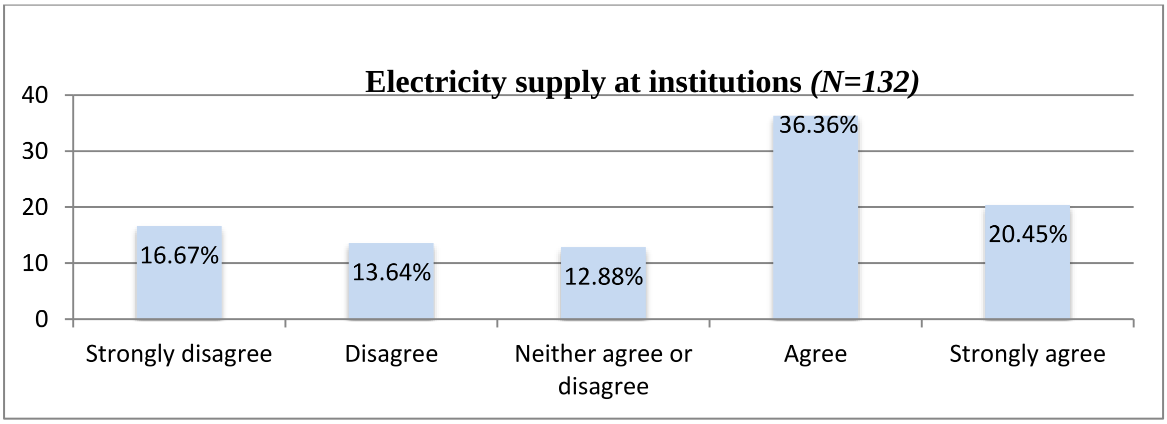
Figure 5.86 Access to databases



5.6.19.4 Stable electricity

Postgraduate students investigated contended that they would use e-resources for research purposes if the electricity supply was more stable at their respective institutions (Figure 5.87). This is reflected by 48 of 132 (36.36%) postgraduate students who *agreed* with this view, while 27 of 132 (20.45%) *strongly agreed* that they would use e-resources for research purposes if the electricity supply was more stable at their respective institutions.

Figure 5.87 Stability of electricity at institution

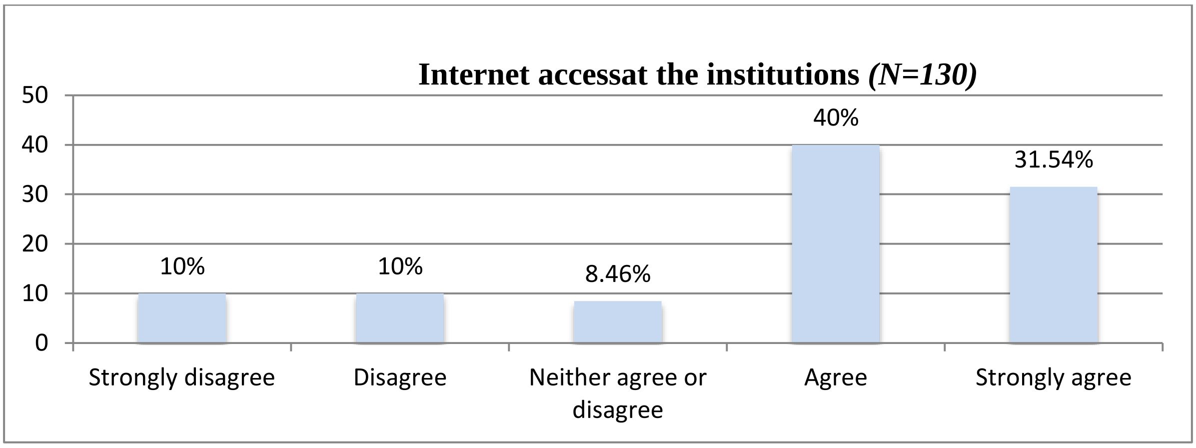


5.6.19.5 Stable internet access at the institution

Figure 5.88 below shows that almost half the postgraduate students investigated (52/130, 40%) *agreed* that they would use e-resources for research purposes if they had stable internet access at their institutions, while almost a third of respondents (41/130, 31.54%)

strongly agreed that they would us e-resources for this purpose if they had stable internet access at their institutions.

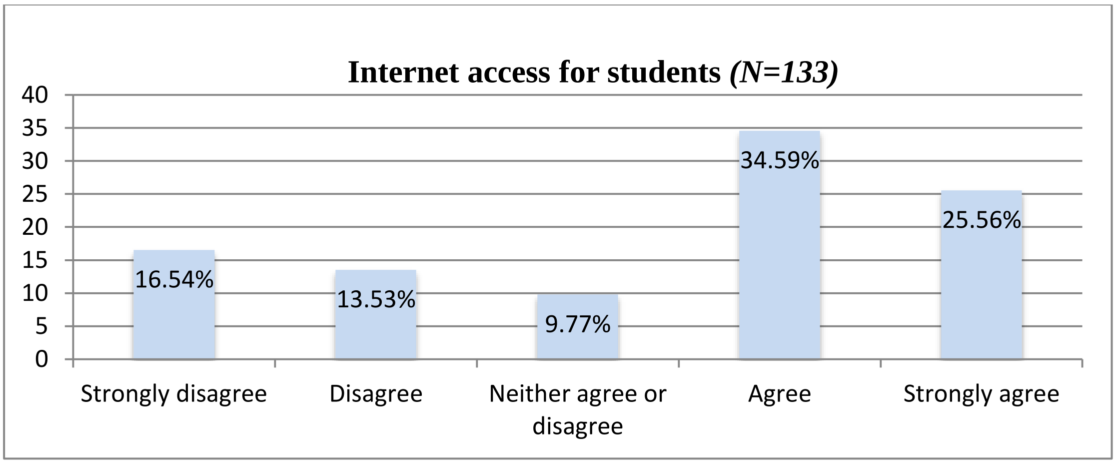
Figure 5.88 Internet access at respective institutions



5.6.19.6 No restriction on internet access

Figure 5.89 below shows that almost a third of respondents (46/133, 34.59%) would have used e-resources for research purposes if there had been no restriction on internet access at their institution, while (13/133, 9.77%) of postgraduate students *neither agreed nor disagreed* that they would use e-resources for research purposes if there had been no restriction on internet access at their institution. In combination, 60.15% respondents *agreed* or *strongly agreed* with the notion.

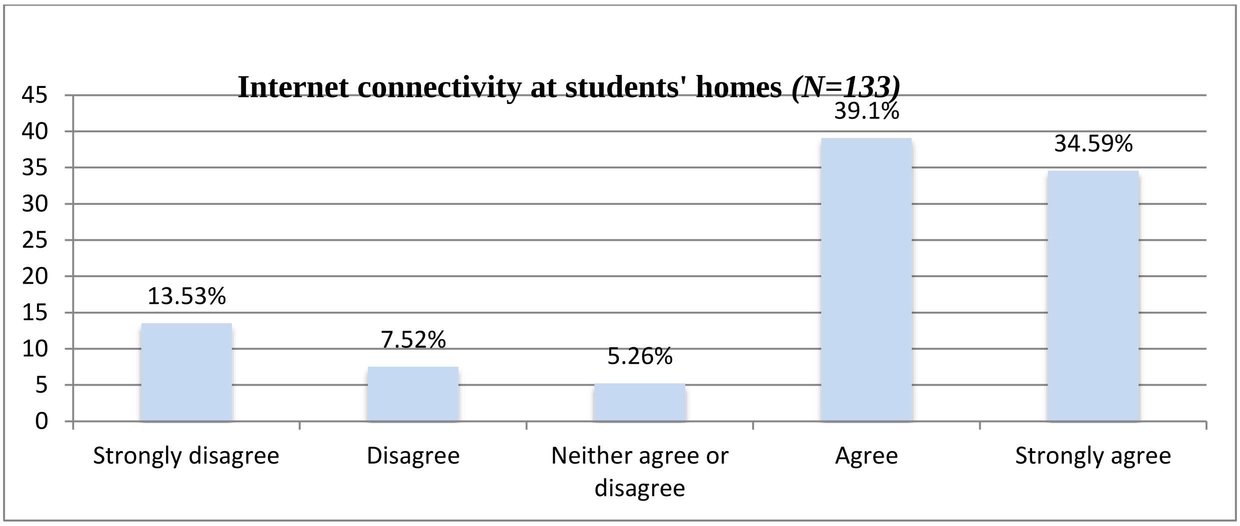
Figure 5.89 Restriction on internet access



5.6.19.7 Internet connectivity at home

Figure 5.90 below shows that more than a third of postgraduate students (52/133, 39.1%) *agreed* that they would use e-resources for research purposes if internet connectivity at their homes was cheaper, while seven of 133 (5.26%) *neither agreed* nor *disagreed* that they would have used e-resources for research purposes if internet connectivity at home was cheaper. In combination, 60.15% respondents *agreed* or *strongly agreed* with the sentiment.

Figure 5.90 Internet connectivity at students' homes



5.6.20 Postgraduate students' training in use of e-resources

Question 20 (Appendix 4) asked if postgraduate students had received training in the use of e-resources from their libraries. Although the students were expected to respond to all options, N differs per option and is indicated in Table 5.70 below.

More than half the respondents (60/108, 55.56%) had received training in accessing databases. About two-thirds of respondents (89/133, 66.92%) had received training in accessing e-journals, while 75 out of 128 respondents (58.59%) had been trained to use Google Scholar.

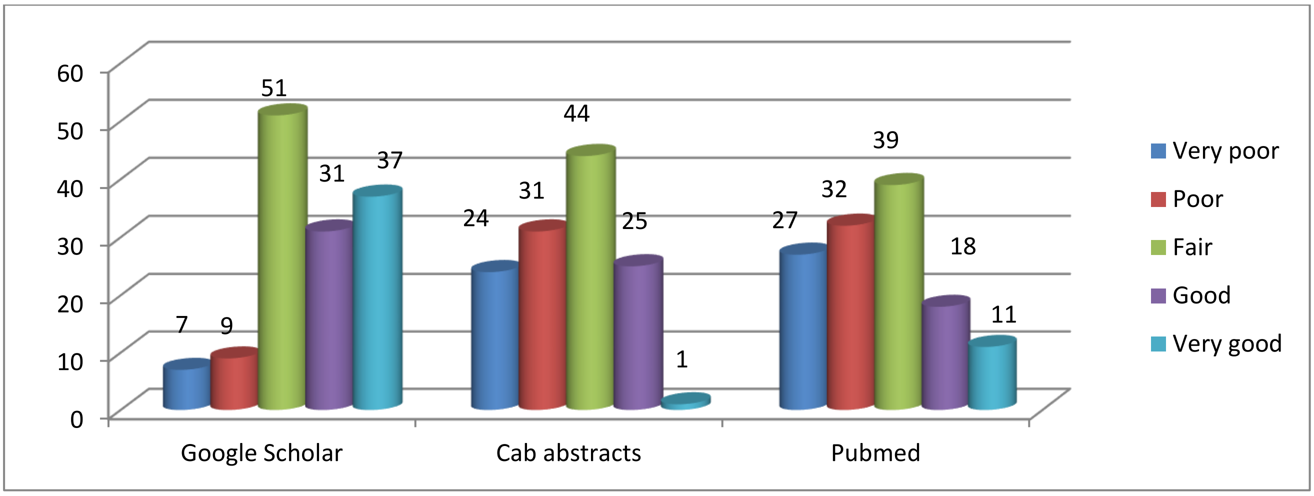
Table 5.70 Postgraduate students' training in use of e-resources

Pstgraduates students training in use of e-resources by libraries	***N***	**Yes**		**No**	
		F	%	F	%
Databases	108	60	55.56	48	44.44
E-journals	133	89	66.92	44	33.08
Google Scholar	128	75	58.59	53	41.41
Other	20	9	45	11	55

5.6.21 Postgraduate students' competence in using databases

When the postgraduate students were asked to rate their skills in using databases the results were positive overall. (Question 21, Appendix 4). Figure 5.91 below presents the results. N differs per e-resource option.

Figure 5.91 Skills in using databases



5.6.21.1 Google Scholar

Asked about their skills in using Google Scholar, 51 of 135 respondents, (37.78%) reported *fair* skills, while more than a quarter (37 of 135 respondents) (27.41%) reported *very good* skills in using Google Scholar.

5.6.21.2 CAB Abstracts

More than a third of respondents (44 of 125 respondents), (35.2%) reported *fair* skills in using CAB Abstracts, while 25 of 125 (20%) indicated *good* skills, with only one respondent (0.8%) reporting *very good* skills in using CAB Abstracts.

5.6.21.3 PubMed

A quarter of the respondents (32 of 127), (25.2%) indicated *poor* skills in using PubMed, while 11 of 127 respondents (8.66%) reported *very good* skills in using PubMed.

5.7 FINDINGS OF THE QUALITATIVE STUDY

Some sections of the questionnaires had open-ended questions that required respondents to make comments and suggestions about the use and non-use of e-resources at the universities surveyed and the problems the users encountered. Responses to the open-ended questions from the four questionnaires (Appendices 1 – 4) were reviewed and a thematic analysis applied to encode the information. The findings are summarised and presented. Where applicable, responses are quoted in verbatim with very limited editing below.

- Several important factors were reported that affect the use and non-use of e-resources by academic staff and postgraduate students in STM disciplines at the universities surveyed.
- The information specialists, academic staff and postgraduate students surveyed regard the problems of IT and internet infrastructure at the universities as an important barrier in the use of e-resources at the institutions.
- User awareness and skills in the use of e-resources were important factors indicated by all three groups (information specialists, academic staff and postgraduate students).
- The need for access to more relevant content required by the STM academic staff and postgraduate students, which they reported, was not satisfied by the libraries at the universities.
- Both academic staff and students highlighted the need for more regular training in the access and use of e-resources at the universities.
- Issues of inadequate available office space and lack of time experienced by academic staff and students were reported as barriers to accessing and using e-resources at the institutions.

Findings from the various groups of participants are discussed in more detail in the following sections.

5.7.1 Library directors or their representatives' perceptions about e-resources training at the universities

Asked about their perceptions about the steps the libraries had taken to address information access problems, (Question 24, Appendix 1) the following points were noted: synchronise training to fit in with academic staff availability; using a variety of training options with one-on-one training; vacation break training; and distribution of e-resources user guides.

Some verbatim quotations included:

The library has always tried to synchronise training of academic staff to periods when they would not be busy, but some still do not attend.

One-on-one training

Vacation and mid-semester break training

Distribution of e-resources user guides

Comments on the library's e-resources, especially the use of e-resources they liked to share (Question 25, Appendix 1), highlighted the libraries' efforts to promote e-resources through social media and training activities for the academic staff and students. The libraries focus on various marketing techniques, training, and on-going encouragement.

Some verbatim quotations included:

The library also provides awareness through database of the week promotion, through the staff portal and students' e-learning, brochures, and promotional materials from service providers and through the university Facebook account.

The library also promotes e-resources use through formal informational literacy skills training.

There is a need to continuously encourage staff and student to use e-resources which are always peer reviewed than to rely on search engine like Yahoo and Google.

5.7.2 Qualitative findings from information specialists at the university libraries

Asked which major subjects the information specialists had studied in their undergraduate degrees, they indicated a variety of subjects. They were asked to write down three major subjects they completed on third-year level (Question 8, Appendix 2). Although this was an open question, the data received was quantitative and Table 5.71 below reflects an analysis of the subjects the respondents indicated. The number after the subjects in the table denotes the frequency with which the subject was named by the respondents. Management information systems (MIS) was mentioned most often (17/38; 44.74%), followed by IT (14/38, 36.84%) and then information science (10/38, 26.32%).

Table 5.71 Information specialists subject majors

Applied information (1) Academic libraries (4) Administration (1) Advanced information & knowledge management (1) Advanced IT (4) Archives management (1) Advanced IT management & information systems (1)	Classification (1) Counselling psychology (1) Current issue in library & information management (1) Communication skills (1) Collection development (4) Cataloguing (7) Comparative librarianship (8) Corporate governance (1)	Database management (1)	Electronic information retrieval (6) English literacy (1) E-resources management (6)	Gender studies (1)
Human resources management (1) Health information reporting (1)	Indigenous knowledge systems (7) Infopreneureship (1) Information literacy (5) Information technology (14) Information science (10) Introduction to media research methods (3) International relations (1) Information policy system (1) IT for the organisation and retrieval of information (1) Information retrieval (7) Information storage (1) Information & communication theory (1)	Knowledge management (1)	Linguistics and communication (1) Library leadership (3) Licencing & negotiation (1) Library marketing (4)	Management & organisation of knowledge (1) Multimedia communication (1) Media & development (2) Media studies (4) MIS (17)
Psychotherapy (1) Print media (1)	References services (6) Research methodology in information science (3) Records management (4)	Special libraries (6) Strategic information planning (1) Statistics (1) Subject organisation (1) Specialised information systems in medicine (1) Specialised information knowledge systems (1)	User services (5)	

The data in Table 5.71 shows that electronic information resources (e-resources) and IT featured strongly in the areas of the information specialists. They are thus well prepared to work with e-resources.

5.7.3 Information specialists' perceptions on use of e-resources at the universities

In Question 26 (Appendix 2) the information specialists were asked for other comments on the use of e-resources that had not been covered in the questionnaire. A thematic analysis was done on their replies (Boyatzis, 1998) using the following five categories. The categories covered issues of connectivitiy infrastructure, access cost, the quality of information retrieved, awareness and skills of the information specialist and other related issues not covered by the four groups:

- Access issues pertaining to IT or internet infrastructure;
- Access issues pertaining to cost of subscriptions;
- Access issues pertaining to relevance of accessible content;
- User awareness and skills issues; and
- Other issues.

5.7.3.1 Access issues pertaining to inadequate IT or internet infrastructure

Information specialists' remarked on inadequate IT and internet infrastructures at the universities, referring to these as influencing access to and use of e-resources at the institutions. Listed below in the box are the respondents' comments on this point. The key points that stood out included inadequate internet bandwidth, limited access to full-text journal articles and e-books, high cost of subscription to some journal databases limiting access, lack of skills to use search engines and databases, the need for continual training on e-resources for academic staff and students, and issues of provided contents relevance to African situation.

Some verbatim quotations included:

E-resources require high bandwidth internet connectivity difficult to get at the university

Ratio of users to avaiable e-resources is too high slowing down the access speeds

5.7.3.2 Access issues pertaining to high cost of journal subscriptions

The perception of information specialists was that high subscriptions for e-resources hindered the access and use of e-resources at the universities. Their comments listed in the box below noted key points: the limited e-resources subscription budgets the libraries had, which limited the databases they could access, the restriction to some databases the users wanted to use and the prohibitively high costs of journal and e-book subscriptions.

The university usually ***does not have money*** *to subscribe to all relevant databases*

The challenge with some of the e-resources are that you might be able to access them without paying for them. Many library users complain that some e-resources do not open because they need to be paid for and the challenge with NUST Library is that ***it cannot pay for all e-resources***

Sustainability of ***e-resources subscriptions may be a challenge*** *in the next year or two*

Ratio of users to the e-resources provided

Restriction of certain journal articles (unable to download), ***cost of certain databases*** *affects usage of e- resources*

Generally subscriptions to ***e-resources database is still very high***

5.7.3.3 Access issues pertaining to relevance of accessible content

Responses from information specialists pointed to the following key issues: issues of lack of relevance to certain subjects required by users (which had a bearing on the use of available e-resources at the universities) the content relevance (with regard to subject content the users required in their areas of specialisation) and the geographic relevance of the content (e.g. relevance to Africa and the limited availability of full-text articles required by the users).

My faculty is Built Environment, we use different database from the one listed in this research

Some of our e-resources lack relevancy due to the fact that we do not have enough funds to choose a better package of e-resources

Some e-resources are specialised according to subjects of interest

In some of the electronic databases, most of the articles we want to download are written purchase, though we have licence to access them but we are being told to purchase e-books or articles

> *E-resource content is usually Eurocentric thereby [out] of touch with African scenarios. Moreover the little Afro-centric content is usually inaccessible in most e-resources database*

5.7.3.4 User awareness and skills issues

The information specialists pointed out the lack of user skills in e-resources and certain databases and the need for training at universities to address the problem. They also raised issues that pointed to lack of awareness by users at the universities on what e-resources were available to them and how to access them. The respondents' verbatim comments listed in the box below pertain to the need for continuous training on e-resources by the users, the level of skills of users, and the level of use of available e-resources.

> *Users require full access to articles and continuous training on how to conduct searches on the web (e-resources)*
>
> *Generally most of the e-resources database that we subscribe to [are] user friendly and once one knows how to search from one then they automatically have an idea of how to access the others*
>
> *One simply needs to be shown how it works so that they appreciate the actual accessing process*
>
> *Most of our e-resources have an average to high usage statistics because of the training we conduct every semester for students and teaching staff*
>
> *There is a general misconception among students and some staff that Google and other search engines are the gateway and knowledge through their ease of use. There is need to provide academic search engines which also provide quick links to peer reviewed material*

5.7.3.5 Other issues raised by information specialists

Some issues that respondents raised touched on the limited negotiation skills the librarians had in dealing with publishers and a concern about sustainability of access to e-resources they had in the following years.

> *Negotiation and licencing skills with publishers requires attention at institutional and*

constitution levels

Sustainability of e-resources subscriptions may be a challenge in the next year or two

5.7.4 Perceptions of academic staff teaching in STM disciplines on use of e-resources

The STM academic staff were asked to specify other issues on the use of e-resources that had not been covered in the questionnaire (Question 25, Appendix 3). Their responses were analysed and categorised into the following:

- Access issues pertaining to IT or internet infrastructure;
- Access issues pertaining to relevance of accessible content;
- User awareness and skills issues;
- Lack of time experienced by academic staff; and
- Other issues raised.

5.7.4.1 Access issues pertaining to IT or internet infrastructure for STM academic staff

The STM academic staff's comments point to a need for improved IT and internet infrastructure at the universities. They specifically noted issues of inadequate internet access and bandwidth at the universities and the limited laboratories to support their studies.

Improve accessibility of internet resources, to make it easy for researchers.

E-resources for virtual laboratories is a very critical element in teaching physics in settings where teaching is limited by equipment in labs.

5.7.4.2 Access issues pertaining to relevance of content for STM academic staff

Several of the comments pointed to the need to improve the content available to the STM academic staff through e-resources at the universities. Issues reported on the inadequate journal titles and online databases and the relevance of the available e-resources.

The institution should make an effort to subscribe to technical journals.

There are some e-journal that were not included in the questionnaire and I know one could not mention all, are such I feel you should have given participants room to alert you the e-journal they use and the frequency e.g. IEEE, Springer to mention just a *few.*

The journals that want very much to use e.g. Annual Review of Plant Pathology or Entomology are not available on the e-resources. Most of the e-resources have fringe journals.

I do not use PubMed [database].

Use of e-resources do not affect many people that [are] studying PhD or Masters these days because they have both local university and international universities where we are registered.

5.7.4.3 User awareness and skills for STM academic staff

STM academic staff respondents' comments indicated the need to train them on access to and use of available e-resources at the universities. Some comments pointed to lack of awareness of what was made available by the libraries and how to access the resources they needed for their teaching, research and learning. The respondents reported on inadequate skills and training in the use of the e-resources, the skills to use specific databases, lack of awareness about the resources available at the universities and the need for federated search services across all available databases at the institutions.

Verbatim quotations to support these issues are listed in the box below.

At [least] two experts for ICT should be employed in each faculty to keep up-skilling lecturers on accessing and effective, efficiency use of e-resources. It is a dynamic area and constant staff training is needed.

E-resources are critical in enhancing academic research activities. It is important to increase users' education so that they can easily mitigate various databases. IL is important.

All lecturers should continuously update their IT knowledge to enhance research and teaching.

They [e-resources] are very useful but knowledge on them limited

Need for awareness to enhance use and encouragement of e-resources in teaching and learning as well.

E-resources and informatics links to reference manager software

There is need to enhance searching of database through use of search engines e.g. SFX.

Use on e-resources as applications

Need more e-resources training

E-resources enable researchers to access current information and material. This will be used for writing peer reviewed papers and making lecture notes.

I would rather have easier access to all database, e-journal, books etc available through my university at the "click" of a button - without having to go to individual database etc - search only - and the search - searches through all uniform on that is available to the university - I do not want to spend time being trained on how to find my way through a convoluted library system.

5.7.4.4 Lack of time experienced by STM academic staff

Respondents raised the issue of inadequate time as a hindrance to the use of e-resources by STM academic staff at the universities surveyed.

Time to focus on research is restricted by the heavy load of courses (two to three per semester) including the high load of administration against the backdrop of limited staff.

There is only one third of the established posts that are filled.

5.7.4.5 Other issues raised by STM academic staff

Logistical issues pertaining to inadequate office space that limits access to e-resources by STM academic staff were also indicated by respondents. The academic staff raised the issues of access to computers and working space at the universities and the need for training on e-resources for both academic staff and students.

There are no questions on office space for access to e-resources. There very limited office space at my university. Often 3-5 lecturers are located in one office making it difficult to work freely.

Why for academic staff only, what of students?

5.7.5 Perceptions of postgraduate students in STM disciplines on use of e-resources

The postgraduate students' responses when asked to specify other issues on the use of e-resources that had not been covered in the questionnaire (Question 22, Appendix 4) were analysed and categorised into the following:

5.7.5.1 Access issues pertaining to IT or internet infrastructure for STM postgraduate students

When asked to provide comments on specific issues on the use of e-resources at the universities that had not been covered in the questionnaire, STM postgraduate students reported problems of IT and internet infrastructure at the universities as a factor that influenced the use of e-resources by students. The respondents raised issues of inadequate and unreliable internet, limited support when facing technical problems, and the issues of access to computers at the university campuses.

There should be no limitation by IT personnel on accessing some important documents

The internet at the UZ is always down. The training on e-resources was done only for two hours without a practical experience, as the internet was down, so it was a theoretical session.

We have no internet access at the lecture halls. The WIFI is poor.

The Wi-Fi reception is very poor [on campus]

All book chapters and other journals must be easy to access on the computers

E-resources [are] difficult to access

Require universities to assist with free anti-virus and internet

Require services on one's personal laptops and computers we use for work

E-resources play a very pivotal role in various disciplines including medical arena and because of globalisation it has enabled access to current academic information

5.7.5.2 Access issues pertaining to relevant content raised by STM postgraduate students

STM postgraduate students mentioned the relevance of content as a factor that influenced the use of e-resources at the universities. The respondents raised the issues of relevance of available publications to their areas of study and issues of access to full-text articles.

Some current relevance publications to be accessed by the students and academics (staff) for free of the university must subscribe to effective article publishers like IEEE, Wiley to cater for computer science students and staff.

The access of full-text journals should not be protected to allow researches and students get free access to these journals

E-resources should facilitate students to have access on up-to-date journal/papers and e-books for free

These should be no limitation by IT personnel on processing some important documents/papers

Access of full journal should not be protected to allow researchers and students get free access to these journals

Expect universities to pay for specific software e.g. Gestat, SPSS

5.7.5.3 User awareness and skills of STM postgraduate students

STM postgraduate student respondents' comments highlight the need for training and improving their awareness and skills on the use of e-resources and specific databases. Issues of lack of and inadequate training on the use of e-resources were reported.

Not user friendly, therefore training on the use of e-resources has to be done so that pupils will be able to use e-resources without difficulties

Aside from training e-resources it is vital that students be mutually taught about the new resources and that the e-resources be user friendly and not require too many steps to obtain full text documents

To be able to use e-resources one has to have background as some people shy away and not willing to ask how to use

With better internet and training in how to access these e-journals and e-books can help students and researches get more access resources to articles in reputable *journals*

Would require more information on free journals

There is need for more training concerning the e-resources and passwords on most or all the databases that are affiliated or subscribed by the university to be given out openly

5.7.5.4 Other issues raised by STM postgraduate students

The postgraduate students were asked to specify other issues on the use of e-resources that had not been covered in the questionnaire. Their responses were analysed and categorised and are reported below. The responses pointed to issues of limited access to relevant full-text articles, inadequate time allocated to doing research, the need to access e-resources in working environments (i.e. after leaving universities). It was also pointed out that the questionnaire had sufficiently covered the issues of e-resources access and use by postgraduate students.

Most people cannot access journal article and electronic material after finishing their studies because their workplaces do not subscribe to the publishing house or they are not research oriented

There is no time set aside for students to be able to use e-resources

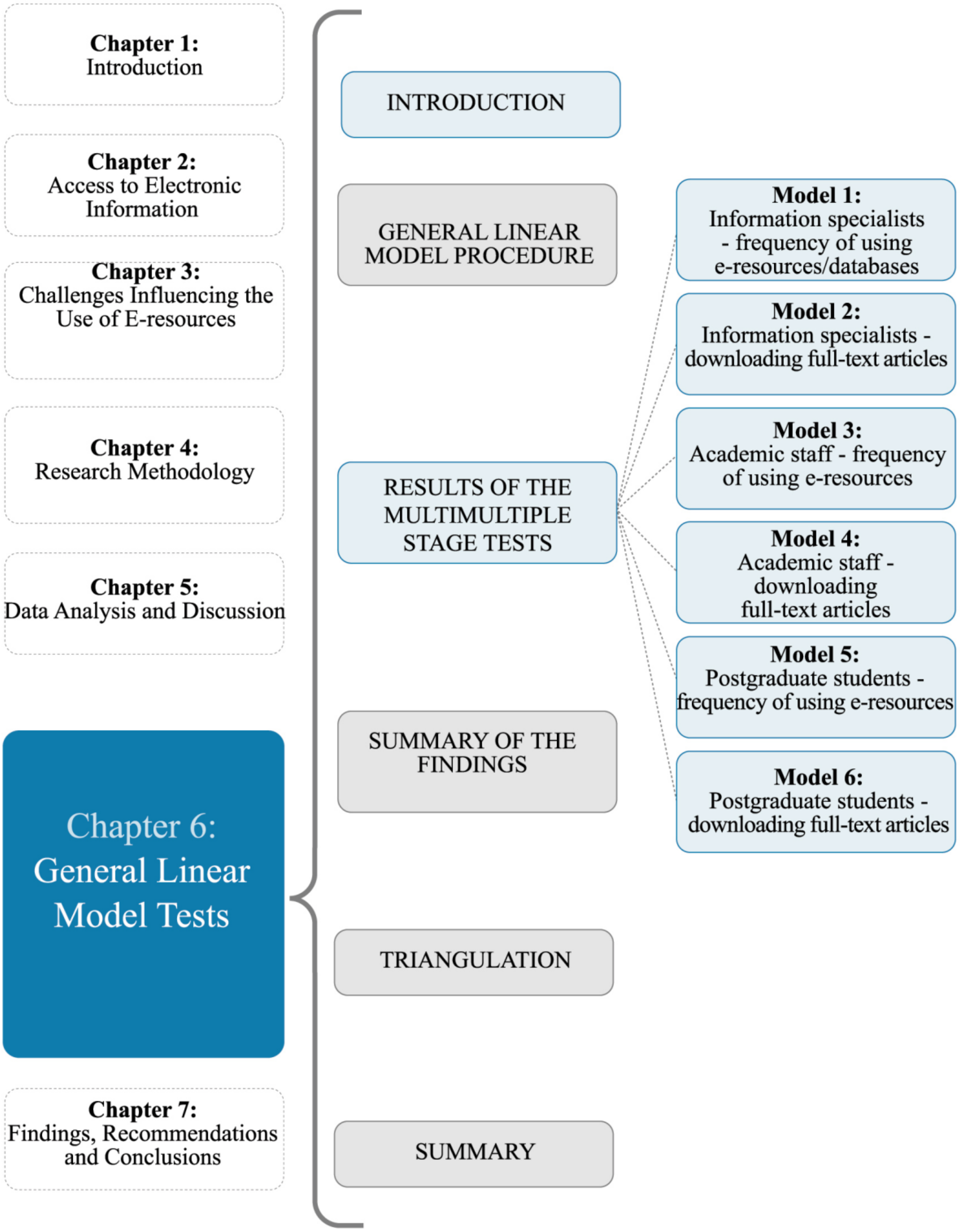
Most journals and textbooks on e-resources require funding and most students cannot afford such facilities and this compromises quality of academic research

Everything has been sufficiently covered

5.8 SUMMARY

This chapter covered the findings of the empirical component of the study focusing on descriptive statistics and qualitative data. The purpose of the study, the research question and the research sub-questions to be answered from the empirical data collection were discussed. The descriptive statistical findings, and findings from the limited qualitative data, were presented. The findings from the different groups (library directors or their representatives, information specialists, academic staff and postgraduate students) were discussed in detail. Factors affecting the use and non-use of the e-resources were highlighted. This chapter concludes with a section on thematic analysis applied to the qualitative data, which highlights the key findings pertaining to access and use of the resources by the four groups of users. Section 6.5 (next chapter) discusses triangulation of the findings from the literature review, descriptive statistics, qualitative data as well as findings from inferential statistics covered in chapter six.

CHAPTER SIX: GENERAL LINEAR MODEL TESTS
Chapter Overview



6.1 INTRODUCTION

This chapter discusses the findings of levels of significance of factors on the use of e-resources by using the general linear model (GLM) procedure (Nelder & Wedderburn, 1972; McCullagh & Nelder, 1989). It thus deals with inferential statistics. Inferential statistical findings are used to contrast descriptive statistics findings in this study. This chapter presents the results of factor analysis as a means to identify factors that may influence information specialists, academic staff and students in the use of e-resources.

The chapter starts by giving an overview of the outputs of the statistical analysis. The stepwise statistical procedures undertaken, using data from the three study groups (information specialists, academic staff and postgraduate students), are explained. The outputs are then discussed for each group. This is followed by a brief triangulation of the findings from the literature, descriptive statistics, inferential statistics and the qualitative data and a summary that concludes the chapter.

6.2 GENERAL LINEAR MODEL PROCEDURE

To understand the degree of relationship and the relative importance among the factors influencing the use and non-use of e-resources by users at the universities, the present study employed the general linear model (GLM) procedure to explore how well a set of factors could affect the frequency of use of e-resources or databases (UeR) and the downloading of full-text articles (DFA).

The GLM procedure uses the method of least squares to fit GLMs. According to Tabachnick and Fidell (2000), the GLM procedure is a flexible statistical model that incorporates normally distributed dependent variables and categorical or continuous independent variables. Among the statistical methods available in GLM are regression, analysis of variance, analysis of covariance, multivariate analysis of variance and partial correlation (Tabachnick & Fidell, 2000; Babbie, 2001).

6.2.1.1 Regrouping of selected independent factors

GLM handles models relating one or several continuous dependent variables to one or several independent variables (Babbie, 2001). The independent variables may be either *classification* variables, which divide the observations into discrete groups, or *continuous* variables.

The GLM procedure was used to test whether the selected factors have a significant influence on the *frequency of UeR* and *DFA*. Before the analysis, several data items were regrouped. According to Tabachnick and Fidell (2000), the data for independent variables in multiple regression analysis should be continuous variables. Continuous variables are measured on a scale that changes values smoothly rather than in steps; examples include age, temperature and distance. For each of the two dependent variables (UeR and DFA) the mean of the responses was calculated and used in the tests, as explained in each of the following sections.

6.3 RESULTS OF THE MULTIPLE STAGE TESTS

After survey data were collected, factor analysis was conducted to extract factors based on the correlations among the data. In this stage, initial sets of measurement items for each factor were examined. To decide whether each factor had enough influencing power, simple regression analysis using the GLM procedure was necessary. The statistical analysis revealed that 17 factors were significant in influencing UeR.

GLM tests were used to indicate to what extent the level of significance of the two dependent variables (*frequency of UeR* and *DFA)* were influenced by the extracted factors as independent variables. The results from the six models are tabulated in Table 6.1 below.

Table 6.1: Results of GLM tests in summary

	Frequency of using e-resources/databases				Downloading full-text articles			
	Variables	**F**	**P**	**R**	**Variables**	**F**	**P**	**R**
		5,250	0,0290	0,1400		4,010	0,0080	0,6100
Information specialists	Position in library - PL (0.0289)				Discipline-agriculture - DIA *** Poor quality of internet access -PQI ** Lack of time to search e-resources - LTSe** Good technical support - GTS *			
		F	**P**	**R**		**F**	**P**	**R**
		3,070	0,0340	0,1300		5,7800	0,0001	0,5800
Academic staff	Academic staff teaching duties - ADT (0.054) Lack of skills to use e-resources - LSU (0.028) Lack of time to search e-resources - LTSe (0.109)				Research and supervision duties - ADR (0.0004) Lack of time to search e-resources - Lse (0.0125) Low cost of internet LCI (0.0118) Relevance of search objectives - RAO (0.0118) Training on databases - ATD (0.0046) Training on e-resources - ATeJ (0.0095) Training on Google Scholar - ATGs (0.0377)			
		F	**P**	**R**		**F**	**P**	**R**
		10,010	0,0001	0.21		3,6300	0,0150	0,0900
Postgraduate students	Degree programme level - DL (0.009) Good technical support - GTS (0.005) Training on Google Scholar - PGS (0.003)				PG degree programme - PDe (0.096) Training on use of e-resources - TeR (0.141) Training on Google Scholar - PGS (0.038)			

*Significant at 1 % (P<0.001)
** Significant at 5% (P <0.05)
***Significant at 10% (P <0.10)

Legend:

F Value and **Pr** > **F** – Are the **F Value** and ***pvalue***, respectively, testing the null hypothesis that the model does not explain the variance of the response variable.

F Value and **Pr** > **F** – Are the **F Value** and ***pvalue***, respectively, testing the null hypothesis that the model does not explain the variance of the response variable.

RSquare – This is the R-square value for the model. The Rsquare defines the proportion of the total variance explained by the model and is calculated as Rsquare = Sum of squares model/sum of squares corrected.

6.3.1 Model 1: Information specialists: frequency of using e-resources or databases

GLM procedure was followed to establish to what extent the dependent variable *frequency of UeR by information specialists* was influenced by 15 extracted factors as independent variables listed below:

- Lack of access to computers (LAC);
- High cost of internet access (HCI);
- Low cost of internet access (LCI);
- Discipline to which information specialists provided information most often: agriculture (DIA);
- Age of information specialists (AI);
- Good technical support when one encounters problems with e-resources (GTS);
- Experience in using e-resources (EUE);
- Poor quality of internet connection that slows down speed (PQI);
- Position in the library (PL);
- Highest qualification in library or information science (HQL); and
- Lack of time to search e-resources (LTSe).

Before running the test, information specialists' responses regarding their position in the library at the universities were grouped into two levels, *senior* and *junior*. The senior level was made up of top and deputy librarians, while the junior level was made up of junior and senior levels. The Likert scale used was regrouped from five to three groups, i.e. group 1=*Strongly disagree and disagree;* group 2= *Neither agree nor disagree* and group 3=*Agree and Strongly agree.*

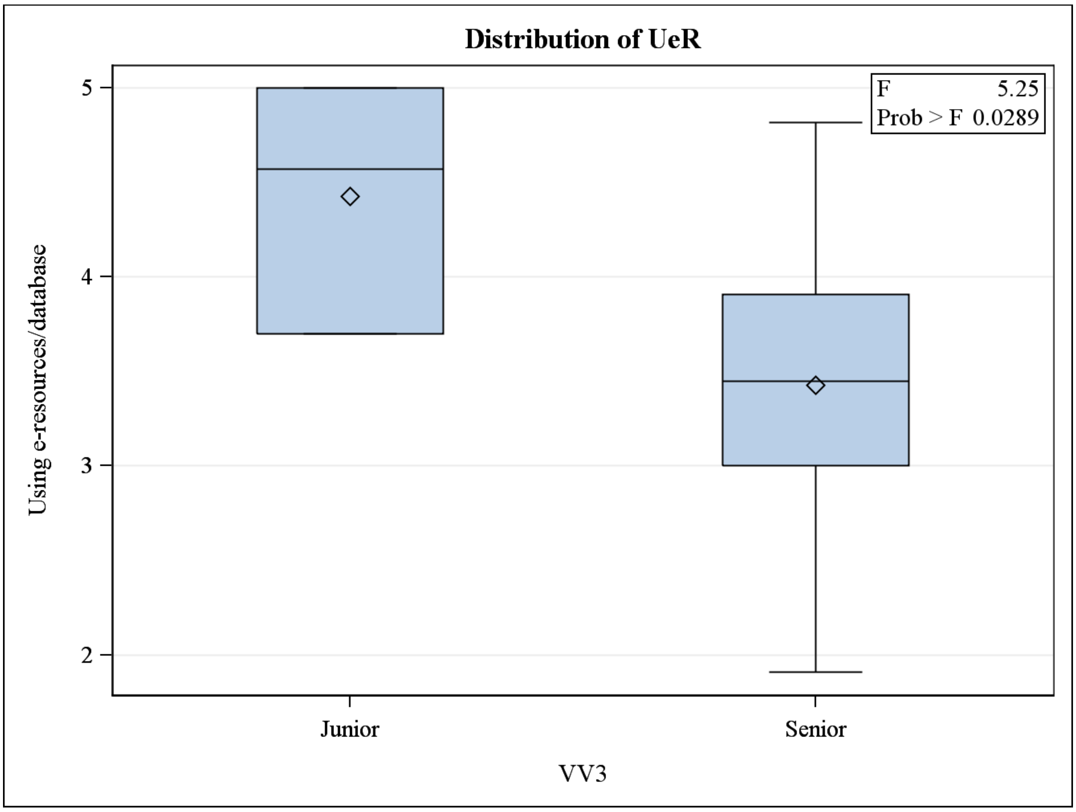
After running a stepwise analysis to identify the factors that influence information specialists' frequency of UeR, the researcher obtained the factor *position in the library* (PL) as a significant variable with a *p-value* of 0.0289, which is less than 0.05.

The whole model explains 14,5% of the variance $R^2 = 0{,}1448$

P= F=5,25, $R^2 = 0{,}1448$

As shown in Figure 6.1 below, the average score for the *junior* level is 4.423, with a standard deviation of 0.6624, and it indicates that the juniors tend to use the databases *often.* The average score of 3.427 with a standard deviation of 0.722 indicates that the senior level tends to use the databases less often compared to the juniors.

Figure 6.1 Distribution of information specialists' use of e-resources



6.3.2 Model 2: Information specialists – downloading full-text articles

The GLM procedure was followed to establish to what extent the dependent variable *frequency of DFA by information specialists* was influenced by 15 extracted factors as independent variables listed below:

- Age of information specialists (AI);
- Position in the library (PL);
- Discipline to which information specialists provided information most frequently: agriculture (DIA);
- Discipline to which information specialists provided information most frequently: science and technology (DIS);
- Highest qualification in library or information science (HQL);
- Poor quality of internet connection that slows down speed (PQI);

- Lack of access to computers (LAC);
- Experience in using e-resources (EUE);
- High cost of internet access (HCI);
- Lack of time to search e-resources (LTSe);
- Low cost of internet access (LCI);
- Good search skills (GSS);
- Training on use of e-resources (TeR);
- Good technical support when one encounters problems with e-resources (GTS); and
- Low cost of internet access (LCI).

After running a stepwise analysis to identify factors that influence information specialists' frequency of DFA, the researcher obtained four significant variables (i.e. *discipline to which information specialists provided information most: agriculture* (DIA); *poor quality of internet connection that slows down speed* (PQI), *lack of time to search e-resources* (LTSe) and g*ood technical support when one encounters problems with e-resources* (GTS) (Table 6.2 below).

Table 6.2 Results of information specialists' frequency of downloading full-text articles

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Discipline to which information specialists provided information most frequently: agriculture (DIA)	1	0.13263766	0.13263766	4.04	0.0597
Poor quality of internet connection that slows down speed (PQI)	2	0.28346437	0.14173218	4.31	0.0295
Lack of time to search e-resources (LTSe)	2	0.31756460	0.15878230	4.83	0.0209
Good technical support when one encounters problems with e-resources (GTS)	2	0.70708662	0.35354331	10.76	0.0008

Of the four factors – the factor of *good technical support when one encounters problems with e-resources* (GTS) had the highest significance value with the F=10,76 P (0,0008).
The whole model explains 60,9% of the variance R^2 = 0,609153

P=0,0082 F=4.01, R^2 = 0,609153

6.3.3 Model 3: Academic staff: frequency of using e-resources

The GLM procedure was followed to establish to what extent the dependent variable *UeR by academic staff* was influenced by 17 extracted factors as independent variables listed below:

- Academic staff duties – research and supervision of students (ADR);
- Relevance to academic staff research objectives and field(s) (RAO);
- Academic staff training on e-journals (ATeJ);
- Unreliable/slow internet access (UIA);
- Academic staff duties – teaching of students (ADT);
- Academic staff: good search skills (AGS);
- Age of academic staff (AAS);
- Academic staff highest qualification (AHQ);
- Academic staff training on use of e-resources (ATeR);
- Academic staff position (AP);
- Low cost of internet use by academic staff (LCI);
- Number of publications by academic staff (NPA);
- Good technical support when one encounters problems with e-resources (GTS);
- Limited access to the internet (LAI);
- Academic staff training on Google Scholar (ATGs);
- Lack of skills to use the e-resources (LSU); and
- Lack of time to search e-resources (LTSe).

After running several rounds of stepwise analysis to identify the factors that have an effect on academic staff's frequency of UeR, the researcher obtained three significant variables (*academic staff duties - teaching of students (ADT), lack of* skills *to use e-resources (LSU)* and *lack of time to search e-resources (LTSe*)). These factors had *p-values* of less than 0.05 (Table 6.3 below).

Table 6.3 Factors influencing academic staff's frequency of using e-resources

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Academic staff duties – teaching of students (ADT)	1	2.90008207	2.90008207	3.85	0.0544
Lack of skills to use e-resources (LSU)	1	3.81610462	3.81610462	5.06	0.0280
Lack of time to search e-resources (LTSe)	1	1.98693427	1.98693427	2.63	0.1096

Of the three factors, *lack of skills to use e-resources* (LSU) was the factor with the highest significance value with F=5,06 P (0,0280)

The whole model explains 12,9% of the variance $R^2 = 0{,}129$

P=0,0343, F=3.07, $R^2 = 0{,}129$

6.3.4 Model 4: Academic staff: downloading full-text articles

The GLM procedure was followed to establish to what extent the dependent variable *DFA by academic staff* was influenced by a set of extracted independent variables. The following identified independent variables were included in the model:

- Number of publications by academic staff (NPA);
- Academic staff training on Google Scholar (ATGs);
- Academic staff position (AP);
- Academic staff training on use of e-resources (ATeR);
- Limited access to the internet (LAI);
- Good technical support when one encounters problems (GTS);
- Relevance to academic staff research objectives and field(s) (RAO);
- Low cost of internet use by academic staff (LCI);
- Academic staff: good search skills (AGS);
- Academic staff duties – research and supervision of students (ADR);
- Unreliable internet/slow internet access (UIA);
- Academic staff duties – administration or other (ADA);
- Academic staff highest qualification (AHQ);
- Lack of skills to use e-resources (LSU);

- Academic staff duties – teaching of students (ADT);
- Academic staff training on databases (ATD);
- Academic staff training on e-journals (ATeJ);
- Age of academic staff (AAS); and
- Lack of time to search e-resources (LTSe).

After running a stepwise analysis to identify the factors that influence the academic staff frequency of DFA, the researcher obtained seven factors as significant variables (i.e. *academic staff duties – research and supervision of students (ADR), lack of time to search e-resources (LTSe), low cost of internet use by academic staff (LCI), relevance to academic staff research objectives and field(s) (RAO), academic staff training on databases (ATD), academic staff training on e-journals (ATeJ), academic staff training on Google Scholar (ATGs*)). These factors had *p-values* less than 0.05 (Table 6.4 below).

Table 6.4 Factors influencing academic staff's frequency of downloading full-text articles

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Academic staff duties – research and supervision of students (ADR)	1	3.60671310	3.60671310	14.80	0.0004
Lack of time to search e-resources (LTSe)	2	2.38031337	1.19015668	4.88	0.0125
Low cost of internet use by academic staff (LCI)	2	1.75065329	0.87532664	3.59	0.0365
Relevance to academic staff's research objectives and field(s) (RAO)	2	2.41813486	1.20906743	4.96	0.0118
Academic staff training on databases (ATD)	1	2.19495279	2.19495279	9.01	0.0046
Academic staff training on e-journals (ATeJ)	1	1.80310435	1.80310435	7.40	0.0095
Academic staff training on Google Scholar (ATGs)	1	1.12399676	1.12399676	4.61	0.0377

Of the seven factors, the factor of *academic staff duties – research and supervision of students* (ADR) had the highest significance value with the F=14.80 P (0.004)

The whole model explains 58.48% of the variance R^2=0,584

P=0,0001, F=5,78 = R^2=0,584

6.3.5 Model 5: Postgraduate students: frequency of using e-resources

The GLM procedure was followed to establish to what extent the dependent variable *DFA by postgraduate students* was influenced by a set of extracted independent variables. The following 15 identified independent variables were included in the model:

- Relevance of postgraduate students objectives and field(s) (RPO);
- Lack of time to search e-resources (LTSe);
- Training on use of e-resources (TeR);
- Postgraduate students' faculty (PF);
- Lack of skills to use the e-resources (LSU);
- Postgraduate degree (PDe);
- Age of postgraduate student (AP);
- Unreliable/slow internet access (UIA);
- Postgraduate degree programme level (DL);
- Limited access to the internet (LAI);
- Low cost of internet use (LCI);
- Postgraduate students training on e-journals (PTeJ);
- Postgraduate students' training on Google Scholar (PGS);
- Good search skills (GGS); and
- Good technical support when one encounters problems (GTS).

After running a stepwise analysis to identify the factors that influence the postgraduate students' UeR, the researcher obtained three factors as significant variables (i.e. *post-graduate degree programme level* (DL), *good technical support when one encounters problems* (GTS) and *postgraduate students' training on Google Scholar* (PGS)). These factors had *p-values less than 0.05* (Table 6.5 below).

Table 6.5 Factors influencing postgraduate students' use of e-resources/databases

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Postgraduate degree programme level (DL)	1	4.55452293	4.55452293	7.04	0.0091
Good technical support when one encounters problems (GTS)	1	5.34040173	5.34040173	8.26	0.0049
Postgraduate students' training on Google Scholar (PGS)	1	6.21232824	6.21232824	9.60	0.0025

Of the three factors, the factor of *postgraduate students' training on Google Scholar* (PGS) had the highest significance value with F=9.60 P (0.0025).

The whole model explains 21.14% of the variance R^2= 0,2114

P=0,0001, F=10.01 = R^2= 0,2114

6.3.6 Model 6: Postgraduate students - downloading full-text articles

The GLM procedure was followed to establish to what extent the dependent variable *frequency of using DFA by postgraduate students* was influenced by a set of extracted independent variables. The following 15 identified independent variables were included in the model:

- Age of postgraduate student (AP);
- Relevance of postgraduate students' objectives and field(s) (RPO);
- Degree programme level (DL);
- Lack of skills to use the e-resources (LSU);
- Lack of time to search e-resources (LTSe);
- Unreliable/slow internet access (UIA);
- Good search skills (GSS);
- Low cost of internet use (LCI);
- Postgraduate students training on e-journals (PTeJ);
- Good technical support when you encounter problems (GTS);
- Training on use of e-resources (TeR);
- Limited access to the internet (LAI);

- Postgraduate degree (PDe);
- Postgraduate students faculty (PF); and
- Postgraduate students training on Google Scholar (PGS).

After running a stepwise analysis to identify the factors that influence postgraduate students frequency of DFA the researcher identified three factors (i.e. *postgraduate degree programme level* (DL), *training on use of e-resources* (TeR) and *postgraduate students' training on Google Scholar* (PGS)). These factors had *p-values* of less than 0.05 (Table 6.6 below).

Table 6.6 Factors influencing postgraduate students' downloading of full-text articles

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Postgraduate degree (PDe)	1	1.13795633	1.13795633	2.81	0.0962
Training on use of e-resources (TeR)	1	0.88960819	0.88960819	2.20	0.1408
Postgraduate students' training on Google Scholar (PGS)	1	1.78709242	1.78709242	4.42	0.0378

Of the three factors, the factor of *postgraduate students training on Google Scholar* (PGS) had the highest significance value with the F=4,42 P (0.0378)

The whole model explains 8,66% of the variance $R^{2\,=}$ 0,0866

P=0,0150, F=3,63, $R^{2\,=}$ 0,0866

6.4 SUMMARY OF THE FINDINGS OF THE GLM PROCEDURE

Model 1 established the effect of the use of e-resources/databases by information specialists. It revealed that the position of the information specialists in the library as a junior or senior had an influence on their use of e-resources or databases. The test indicates that the juniors tended to use the e-resources or databases more often than the seniors did.

The Model 2 results identified four significant variables that have an effect on the down loading of full text articles (DFA) by information specialists, i.e. *discipline to which information specialists provided information most frequently – agriculture (DIA), poor* *quality of internet connection that slows down speed (PQI), lack of time to search e-resources (LTS),* and *good technical support when one encounters problems with e-resources (GTS).* The test indicated that *good technical support when one encounters problems with e-resources (GTS)* was the factor that had the most significant influence on the downloading of full-text articles by information specialists.

Model 3 results identified three significant variables that had an effect on the UeR by academic staff in STM disciplines at the participating universities (i.e. academic staff duties – teaching of students (ADT), lack of skills to use e-resources (LSU)**,** lack of time to search e-resources (LTSe)). *Lack of skills to use e-resources* (LSU) was the factor with the highest significance compared to the other two.

Model 4 results identified seven factors as significant variables with academic staff frequency of DFA (i.e. *academic staff duties – research and supervision of students (ADR), lack of time to search e-resources (LTSe), low cost of internet use by academic staff (LCI), relevance to academic staff research objectives and field(s) (RAO), academic staff training on databases (ATD); academic staff training on e-journals (ATeJ), academic staff training on Google Scholar (ATGs*)). The test established that the factor of *academic staff duties – research and supervision of students* (ADR) had the highest significance value.

Model 5 established three factors influencing postgraduate frequency of UeR, i.e. *post-graduate degree programme level* (DL), *good technical support when one encounters problems* (GTS) and *postgraduate students training on Google Scholar* (PGS) as significant variables. PGS was the factor established to have the highest significance compared to the other two.

Model 6 identified three factors influencing the postgraduate frequency of using DFA, i.e. *postgraduate degree programme level* (DL), *training on use of e-resources (TeR)* and *post-graduate students' training on Google Scholar* (PGS), as significant variables. PGS was the factor with the highest significance compared to the other two.

6.5 TRIANGULATION

Triangulation concerns collecting information from a diverse range of individuals and settings using a variety of methods (Denzin, 1970; Powell, 1992, Clarke & Dawson, 1999; Davies, 2007; Denzin, 2012; Howe, 2012; Greene, 2015; Shannon-Baker, 2016). As discussed in section 4.3.7, the idea of triangulation is that the phenomenon under study can be understood best when approached with a variety or combination of research methods (Given, 2008; Flecha, 2014; Mertens, 2015).

Triangulation, as a multi-method approach, is seen to be a research strategy that can reduce biases or deficiencies caused by using only a method of enquiry (Mouton & Marais, 1990; Powell, 1992; Clarke & Dawson, 1999; Bryman, 2001; Davies, 2007; Given, 2008) and as explained by Torrance (2012), Willis, Jost and Nilakanta (2007), Bickman and Rog (2009), Fox and Bayat (2007), Bickman and Rog (2009), Denzin (2012), Mertens (2015) and Shannon-Baker (2016), triangulation has its origins in attempts to validate research findings by generating and comparing different sorts of data, and different respondents' perspectives, on the topic under investigation.

This study employed triangulation by comparing findings from quantitative and qualitative questions in the questionnaires which generated descriptive and qualitative data, as well as findings from inferential statistics. A multi-strategy approach was used: a literature review, descriptive statistics, qualitative data and inferential statistics to validate the research findings. In section 4.3.7, triangulation is explained under the heading Intra-method and inter-method mixing. In the following paragraphs the essence of answers to the research problem as captured in the findings through different methods is captured. The discussion is kept brief so as not to overlap with the summary of the empirical study in Chapter 7.

The most commonly cited barrier to use of scholarly literature has been high subscription costs associated with journal literature (Mark Ware Consulting Ltd 2006; Kiondo, 2008; Dulle, 2015; Lawson, 2015). Literature review in this study revealed that this is no longer a major barrier as free and low cost scholarly databases are now sometimes available through free or low cost initiatives that have been launched and available at academic institutions in developing countries in the past two decades. The study showed that at developing countries' tertiary institutions, thousands of electronic scholarly resources are available free or at low cost online (Rosenberg, 2008; Harle, 2009; Dulle, 2015). The descriptive statistics in this study supported this finding.

However, use of low cost or free e-resources by users in developing countries, although gradually growing, is still very low, particularly in tertiary and research institutions in Sub-Saharan Africa (Megersa & Mammo, 2008; Musoke & Kinengyere, 2008; Ajuwon &

Olorunsaye, 2013; Dhanavandan, 2014; Miller, 2014; Mugwisi, 2015; Akporhonor & Akpojotor, 2016). Descriptive statistics in this study and qualitative data analysis established significant awareness and use of specific e-resources and databases by information specialists (section 5.4.12) and postgraduate students at the universities (section 5.6.19). Yet they are not using these resources very much (sections 5.4.14, 5.4.15, 5.6.10, 5.6.12, 6.3.2, 6.3.6).

Both descriptive and inferential statistics supported the significance of several factors that influence the low use of e-resources by information specialists, academic staff and postgraduate students at the universities. Inferential statistics confirmed how each of the 17 identified factors had some influencing power on use of e-resources; simple regression analysis was undertaken to test the significance of the factors. As discussed in section 6.3.3, the identified factors constituted academic staff duties – research and supervision of students (ADR); relevance to academic staff research objectives and field(s) (RAO); academic staff training on e-journals (ATeJ); unreliable/slow internet access (UIA); academic staff duties – teaching of students (ADT); academic staff: good search skills (AGS); age of academic staff (AAS); academic staff highest qualifications (AHQ); academic staff training on use of e-resources (ATeR); academic staff position (AP); low cost of internet use by academic staff (LCI); number of publications by academic staff (NPA); good technical support when one encounters problems with e-resources (GTS); limited access to the internet (LAI); academic staff training on Google Scholar (ATGs); lack of skills to use the e-resources (LSU); and lack of time to search e-resources (LTSe). This indicates that the use relates to task related duties for the academic staff.

For information specialists, the factor *position in the library* as a significant variable in influencing their frequency of downloading full-text articles, while factor of *good technical support when one encounters problems with e-resources* had the highest significance in information specialists' frequency of downloading full–text articles (section 6.3.2).

The simple regression analysis results indicate that junior information specialists' tended to use the e-resources or databases more often than the seniors did (section 6.3.1). This complements the findings of the literature review that established that the Net Generation (Generation Y) tended to be more skilled in the use of ICTs and the internet. The better use of databases, e-books and e-journals by the Net Generation than the generation before them

(Oblinger & Oblinger, 2005; Kennedy *et al.* 2007; Sherman, 2015) features in literature review discussed in section 3.3.2.

For academic staff, *lack of skills to use e-resources (LSU)* was the factor established of high significance value on their frequency of using e-resources. This complements the accession established by the literature review and the qualitative data where they note the importance of relevant user skills such as learning to identify relevant sources of information, formatting searches properly in order to find required information and the need to continously train and update academic skills on the use of databases in order to keep up with the database feature changes and improvements (sections 2.5.3 and 5.7.4).

For postgraduate students, the factor of *training on Google Scholar* (PGS) was established to be of high significance on their frequency of using e-resources, which literature reviewed confirmed. Training in Google Scholar improves users search skills which is a core competence in finding and retrieving information from e-resources and databases. For information specialists their level as junior or senior information specialists is the factor with the highest significance in the frequency of using e-resources. The junior staff tended to use the e-resources more frequently than their seniors.

As found in the literature review, the factor of *academic staff duties – research and supervision of students* had the highest significance value on downloading of full-text articles by academic staff. The same factor had the highest significance value with regard to academic staff's frequency of downloading of full-text articles (section 6.3.4). Academic staff involved with research and supervision of students tended to use e-resources more than those without those duties. A point also supported by qualitative data analysis findings (section 5.7.4).

For postgraduate students *training on Google Scholar* was the factor found to have the highest significance compared to *postgraduate degree programme level* and *good technical support when one encounters problems*. This complements the fact established through qualitative data analysis: e-resources and databases training is needed for students. Training on Google Scholar helped improve search skills that are key competencies in using e-resources and databases effectively.

Inadequate IT and internet bandwidth and power outages are barriers cited by studies as facing information users at tertiary institutions in developing countries (Callison, 1997; Lwoga *et al*., 2007; Ajuwon & Olorunsaye, 2013; Mugwisi, 2014; Dulle, 2015; Gaible, 2015; Akporhonor & Akpojotor, 2016).

Contrary to the idea that access to computers is an important barrier to accessing e-resources at academic institutions (Rosenberg, 2008; Musoke & Kinengyere, 2008; Gaible, 2015), this study's descriptive statistics found that this is no longer a significant barrier for information specialists, academic staff and postgraduate students at the universities (sections 5.4.18, 5.5.19 and 5.6.16.

Contrary to the literature review findings, in this study the descriptive statistics established that a majority of academic staff and information specialists indicated that high cost of internet was not a significant barrier on the use of e-resources at the institutions (sections 5.4.18 and 5.5.19). While qualitative data analysis supported the literature review that the students found the barrier to be significant (section 5.7.5). This was consistent with the descriptive statistics finding that indicated that low cost of internet access influenced use of e-resources by postgraduate students (5.6.19).

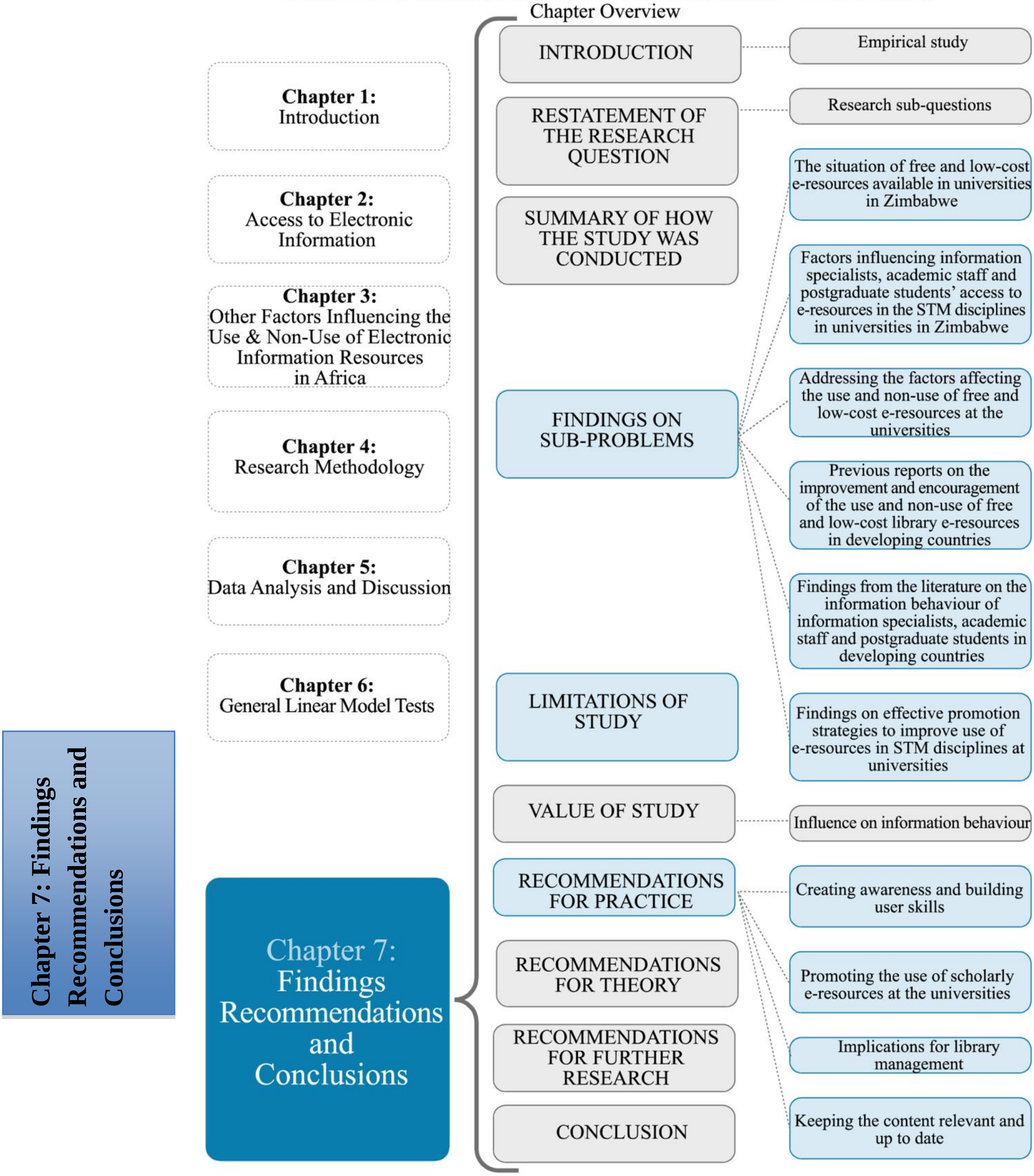
Another category of barriers to the use of e-resources highlighted by the literature review was lack of user skills characterised by lack of awareness, and low information competency by e-resources users at academic institutions. Descriptive and inferential statistics supported the notion established through the literature review for academic staff and postgraduate students.

For information specialists issues of their level of seniority had an impact on their use of e-resources as established through the inferential statistics findings. Juinor level information specialist tended to used e-resources and databases more often than the senior level counterparts (section 6.3.1).

6.6 SUMMARY

This chapter gives an overview of the outputs after analysis of variance run through a GLM. It discusses the findings of levels of significance of factors on the use of e-resources and frequency of downloading databases by GLM procedure. The stepwise procedures undertaken using data from the three study groups (information specialists, academic staff and postgraduate students) are explained. The outputs are discussed for each group and a summary of the findings listed. An explanation about triangulation, as a multi-method approach, concludes the chapter.

CHAPTER SEVEN: FINDINGS, RECOMMENDATIONS AND CONCLUSIONS



7.1 INTRODUCTION

This is the final chapter - the chapter presents a summary of the empirical research design employed and discusses the findings on each of the six sub-questions. Recommendations for practice, theory and further research are covered and the chapter closes with the study conclusion.

The purpose of this study was to investigate factors affecting the use and non-use of free and low-cost library e-resources by information specialists, academic staff and postgraduate students in STM disciplines at universities in Zimbabwe in order to recommend policy and guidelines to promote the use of these e-resources and for the improvement of information literacy training to support the use of these databases at the universities.

Chapter 1 introduced the research question and its context. Literature on access to electronic information resources at tertiary education institutions and other factors influencing use and non-use of electronic information resources in Africa was analysed in Chapters 2 and 3 to inform the study. Chapter 4 discussed the research design and data collection method used in the empirical component of the study. The data analysis for descriptive statistics and qualitative data was reported in Chapter 5. Chapter 6 discussed the modelling analysis results. This chapter presents the findings, discussion and conclusions of the study. The chapter focuses on re-visiting the study's research question and sub-questions with brief summaries of the findings.

Apart from a summary of the research design, and the findings to sub-questions and the research question, this chapter presents recommendations for theory and practice. Recommendations for practice are covered in more detail and recommendations for further research are also included. A few overall concluding remarks on the thesis end this chapter.

7.2 RESTATING THE PROBLEM STATEMENT AND RESEARCH QUESTION

The purpose of this study was to investigate factors affecting the use and non-use of free and low-cost library e-resources by information specialists, academic staff and postgraduate students in the scientific, technological and medical (STM) disciplines at universities in Zimbabwe with the intention to recommend policy and guidelines to promote the use of these e-resources and for the improvement of information literacy training to support the use of these databases at the universities.

7.2.1 Research question

What are the factors affecting the effective use of free and low-cost e-resources by information specialists, academic staff and postgraduate students in the STM disciplines at universities in Zimbabwe?

7.2.2 Research sub-questions

To address the main research question, data were collected in order to answer the following sub-questions (these were also stated in Chapter 1 and discussed in section 4.1.2):

i. What is the *status quo* of free and low-cost e-resources available at universities in Zimbabwe?
ii. What has been reported about the use of free and low cost e-resources and information behaviour in this regard, especially concerning developing countries?
iii. What has been reported on the improvement and encouragement of the use of free and low cost e-resources in developing countries?
iv. Which factors are influencing academic staff, postgraduate students and information specialists' *access* to e-resources in STM disciplines at universities in Zimbabwe?
v. Which factors are influencing academic staff and postgraduate students and information specialists' *use* of e-resources in STM disciplines at universities in Zimbabwe?
vi. How can the use of e-resources at universities in Zimbabwe be effectively promoted in order to increase the use of these resources by academic staff and information specialists at these universities?

A brief summary to each of the questions is provided in sub-sections 7.4.1 to 7.4.7. For questions (ii) and (iii) details are given in Chapters 2 to 3 and for questions (i), (iv), (v) and (vi) see Chapters 5 and 6.

7.3 SUMMARY OF THE RESEARCH DESIGN OF THE EMPERICAL STUDY

The empirical component of the study generated data from a sample consisting of library staff, academic staff and postgraduate students from five universities in Zimbabwe. From May to July 2015 quantitative and qualitative data were collected through questionnaires administered to library directors, information specialists responsible for e-resources at the libraries, academic staff and postgraduate students in STM disciplines at the five universities.

Table 7.1 presents in summary how the empirical component of the study was conducted.

Table 7.1 Summary of the empirical study

Study	Factors affecting the use and non-use of e-resources by information specialists, academic staff and postgraduate students in STM disciplines at universities in Zimbabwe.
Objectives of the study	• To establish the factors contributing to access to, use and non-use of these free and low-cost e-resources by academic staff, information specialists and postgraduate students in STM disciplines at five universities in Zimbabwe. • To recommend policy and guidelines to promote the use of these e-resources and for the improvement of information literacy training to support the use of these databases at the universities.
Literature review	September 2009 to July 2016
Data collection	May to July 2015
Study sites and participants	The data were collected at five universities in Zimbabwe with STM disciplines offering postgraduate programmes. There are 14 public and private universities operating in Zimbabwe. Seven run postgraduate degree programmes; five are public and two are privately owned. Of these, five offer postgraduate degree programmes in the STM fields. The study was conducted at the five universities (i.e. Africa University (AU), Chinhoyi University of Technology (CUT), Midlands State University (MSU), the National University of Science and Technology (NUST) and the University of Zimbabwe (UZ)). The student population at the five selected universities stood at about 30 000 in 2015. STM schools had about 700 postgraduate students, 150 academic staff and 40 information specialists charged with e-resources. Four groups were surveyed at the universities (directors of the libraries, information specialists responsible for e-resources at the libraries, academic staff and postgraduate students (master's and doctoral students) enrolled in the STM disciplines).
Data collection	Self-administered semi-structured questionnaires were used to collect data from the four groups in order to establish the factors and contribute to the body of knowledge aimed at improving the use of library e-resources at the institutions. The questionnaires were administered in printed format. In the survey, four of the five library directors, 38 information specialists charged with e-resources, 80 academic staff teaching in STM disciplines and 136 postgraduate students in STM disciplines returned completed questionnaires.
Research approach	Quantitative, with very limited qualitative input. Although the majority of the questions in the questionnaires were quantitative questions, limited qualitative data were also collected through open-ended questions.
Research method	Survey
Study ethics clearance	The study received ethical clearance to conduct the research from the Faculty Committee for Research Ethics and Integrity, Faculty of EBIT at the University of Pretoria (Appendix 4: Ethics approval letter dated 24 February 2014). Approval from the five universities that participated in the study were sought and granted

	before the study (Appendices 6 and 7)
Data confidentiality	Data collected from study participants are confidential and were only used for the purpose of the study. Respect for the autonomy of participants in research is the ethical basis for the recognition of participants' right to privacy. The collected data were reviewed and cleaned by the researcher with the assigned statistician at the Department of Statistics, University of Pretoria. No data was shared beyond the research team, to ensure that data was treated confidentially.
Survey instruments validity and reliability	Developed questionnaire drafts had several iterations as preliminary versions for feedback before applying the final versions, as a measure to ensure instruments' reliability. Questions used in the surveys were developed to measure variables established through the literature review and benchmarking with those used in similar studies. A pilot study was run with the questionnaires with a small group of postgraduate students, information specialists and academic staff before they were reviewed and finalised.
Analysis	Data analysis was carried out using SPSS with the assistance and advice of the statisticians at the Department of Statistics, University of Pretoria. The analysis included descriptive and inferential statistics and thematic analysis for qualitative data.

7.4 FINDINGS ON SUB-PROBLEMS

The following sections discuss the findings of this study as related to the sub-questions of the study and according to each specific group, i.e. information specialists, STM academic staff and postgraduate students surveyed at the four universities in Zimbabwe.

7.4.1 The situation of free and low-cost e-resources available in universities in Zimbabwe

Studies by Rosenberg (2006), Harle (2009), the Association of Commonwealth Universities (2011) and Malapela and De Jager (2015) found that many of the universities in Zimbabwe were registered for e-resources access schemes providing low-cost and free scholarly resources available through the PERI and Research4Life programmes (HINARI, AGORA, OARE, ARDI). These programmes provide universities with access to thousands of e-journals and e-books through several databases. The library directors and information specialists in this study confirmed this point.

7.4.1.1 Access to e-resources at the Zimbabwean universities

In this study the survey found that e-resources constituted large collections of e-resources at the four universities who responded, with ranges of up to 200 000 e-journal titles, with a mean of 138 e-journal titles accessible through various databases. The number of accessible e-books ranged from just 20 to 928 336, with a mean of 302 089. The number of electronic theses or dissertations ranged from 326 to 3 601, with a mean of 4 400 (section 5.3.7).

The university libraries reported that *all four libraries* where the directors participated in the survey provided their users with access to online databases including EBSCO Host, Emerald, HINARI, JSTOR and TEEAL (section 5.3.9 to 5.3.10).

7.4.1.2 Access to full-text articles at the universities

The library directors or representatives were positive that the e-resources they provided to their users gave access to full-text articles via electronic, inter-library and print services (section 5.3.11). The four libraries gave access to thousands of full-text articles through e-journals and e-book collections available through databases such as EBSCO Host, Emerald, HINARI, JSTOR and TEEAL. However, only two of the four libraries provided their users with access to these databases when they were off campus. This therefore limited access for their users who did not have reliable internet access when off campus.

7.4.2 Findings from the literature on the information behaviour of information specialists, academic staff and postgraduate students in developing countries

Chapters 2 and 3 dealt with the literature analysis that addressed this sub-question.
In essence, the literature review showed that although increased availability and accessibility of e-resources have contributed to an improvement in the dissemination of scholarly information at tertiary institutions, inadequate user skills and low usage of available resources by information specialists, academic staff and postgraduate students remains a problem. Problems of information seeking behaviour, user preferences and different patterns of use by different user groups are some of the additional challenges that were established and need to be addressed if the use of e-resources at tertiary institutions in developing countries are to improve.

7.4.3 Previous reports on the improvement and encouragement of the use and non-use of free and low-cost library e-resources in developing countries

Chapters 2 and 3 dealt with the literature analysis that addressed this sub-question. Actively promoting e-resources targeting specific audiences affects the use of the e-resources. Creating awareness about the e-resources, actively promoting the resources; providing training on the use of the e-resources and making them easily accessible play an important role in influencing the use of free and low-cost e-resources in developing countries.

The empirical study reflected respondents' viewpoints regarding the influence of contextual, personal and technological factors affecting the respective user groups' information behaviour. The following identified factors enhance use of e-resources and prevent non-use (i.e. ease of use of e-resources; availability of full-text articles; good searching skills; good searching skills and training on e-resources).

7.4.3.1 Ease of use of e-resources

The study confirmed that ease of use of e-resources enhanced the use of available e-resoources by information specialists, academic staff and postgraduate students.

The study confirms arguments reported in other studies that perceived ease of use, relevance, trust, and ease of access to e-resources are important factors in their use and non-use (Miller & Khera, 2010; Denny, *et al*., 2015).

7.4.3.2 Availability of full-text articles

Information specialists and academic staff were positive that the availability of full-text articles influenced the use of e-resources.

7.4.3.3 Good searching skills

The study findings confirmed the fingings of the literature review that good searching skills enhances use of e-resources by the three groups (Rosenberg, 2008; Dulle, 2015).

As discussed in 2.5.3, addressing problems in dealing with information content and user skills, a common point in the literature is the paradoxical situation that although an abundance of information is available, it is often difficult to obtain useful, relevant information when it is needed (Edmunds & Morris, 2000; Dillon, 2001; Frame, 2004; Palladino, 2011; Mugwisi, 2015).

7.4.3.4 Training on e-resources

The findings identified that training on e-resources enhanced the use of e-resources by information specialists, academic staff and postgraduate students - confirming the findings of the literature review (Rosenberg, 2006; Harle, 2009; Association of Commonwealth Universities, 2011; Malapela & De Jager, 2015).

7.4.3.5 Difference in use across disciplines

Several recent studies have shown that the use of e-resources and other sources of information may differ, depending on the discipline. Users in different disciplines embrace e-resources at different rates and rely on different types of e-resources (Mahé, Andrys & Chartron, 2000; Talja & Maula, 2003; Tenopir *et al.*, 2003; Fraiha, 2012; Tripathi & Kumar, 2014; Al-Suqri & Al-Aufi, 2015).

7.4.3.6 Important factors affecting the use of e-resources

The GLM procedure tests indicated that the position of information specialists played an import role in how they used e-resources, with more senior information specialists using the resources more often than their juniors.

In the case of the academic staff, *academic staff duties,* especially teaching of students, *lack of skills to use e-resources* and *lack of time to search e-resources* affected the use of e-resources.

Three important factors influenced postgraduate frequency of using e-resources; the *post-graduate degree programme level*, *good technical support when one encounters problems* and *postgraduate students' training on Google Scholar* were identified as significant factors.

7.4.4 Factors influencing information specialists, academic staff and postgraduate students' access to e-resources in the STM disciplines in universities in Zimbabwe

As discussed in Chapters 2, 3 and 5, access to digital libraries in Zimbabwean tertiary institutions is faced by challenges of electricity or power outages, inadequate IT and internet infrastructure deficiencies (i.e. lack of access to computers, internet bandwidth shortages, slow/unreliable internet connectivity) at institutions.

Several studies have identified similar factors that influence access to e-resources by users at African tertiary institutions (Mbambo, 2006; Lwoga *et al*., 2007; Musoke & Kinengyere, 2008; Rosenberg, 2008; Ajuwon & Olorunsaye, 2013; Chikwanha, 2014; Mugwisi, 2014; Dulle, 2015).

7.4.4.1 Electricity outages at institutions

Respondents at the five universities surveyed indicated that electricity interruption was a problem at the institutions confirming the literature review findings. As discussed in section

2.5.4, unreliable power is one of the major barriers to the use of e-resources and computers in many tertiary institutions in Africa (Smith *et al.*, 2007; Oyedapo & Ojo, 2013; Dulle, 2015).

7.4.4.2 Access to computers

Responses by academic staff, information specialists and postgraduate students indicated an improvement in access to computers at the institutions surveyed. The perception of information specialists, academic staff and postgraduate students was that access to computers was no longer a barrier to access to e-resources, contrary to the findings of the literature.

7.4.4.3 Slow or unreliable internet connectivity

While all three groups (information specialists, academic staff and postgraduate students) cited internet speed as an important barrier to access to resources, they perceived this barrier and other barriers differently. For instance, the cost of internet was not as great a problem for the academic staff as it was for students. A majority of academic staff indicated that they *disagreed* that poor quality of internet connection that slows down speed influenced non-use of e-resources. (section 5.5.16).

The study findings confirm the findings of the literature review that slow or unreliable internet connectivity is an important barrier to accessing e-resources at developing country tertiary institutions (Harle, 2009; Oyedapo & Ojo, 2013; Mugwisi, 2014).

7.4.4.4 Problems with login or passwords to databases

Problems with login passwords giving access to available e-resources and databases were reported by academic staff, information specialists and postgraduate students. For instance, about half of the academic staff respondents reported that they *agreed* that login/password requirements to access Research4Life programmes (AGORA, HINARI, OARE, ARDI) were important barriers in the use of the databases at the institutions.

7.4.5 Factors influencing information specialists, academic staff and postgraduate students' use of e-resources in STM disciplines at universities in Zimbabwe

Several recent studies have also reported that limited relevant content, lack of awareness of available resources by potential users and users' inadequate skills are barriers to the use of e-resources at higher education institutions in developing countries **(**Frame, 2004; Lwoga *et al.*, 2007; Manda, 2008; Musoke & Kinengyere, 2008; Rosenberg, 2008; Research4Life, 2009;

Kinengyere & Olander, 2011; Ajuwon & Olorunsaye, 2013; Toteng, Hoskins & Bell, 2013; Mugwisi, 2014: Dulle, 2015).

This study confirmed that the following factors enhance or hamper the use of e-resources (content problems; unavailability of full-text articles; too many steps required before getting a full-text article; lack of awareness of available e-resources; and inadequate user skills; high cost of internet access and lack of time.

7.4.5.1 Content problems

As discussed in section 2.5, the most commonly cited barrier to use has been identified as high subscription costs associated with journal literature (Mark Ware Consulting Ltd, 2006; Kiondo, 2008; Dulle, 2015; Lawson, 2015), but this may be only part of the problem (Kiondo, 2008; Dulle, 2015).

7.4.5.2 Unavailability of full-text articles

As identified in literature review (section 2.5) unavailability of full-text articles e-resources by the three user groups (Research4Life, 2009; Ajuwon & Olorunsaye, 2013; Mugwisi, 2014; Dulle, 2015; Gaible, 2015). This study confirms the finding.

7.4.5.3 Too many steps required before getting a full-text article

Another factor cited as influencing the non-use of e-resources was that too many steps are required before getting a full-text article. The perception of information specialists and academic staff confirmed this finding.

7.4.5.4 Awareness and inadequate user skills

On the perception of the problem of inadequate skills or a lack of skills hindering the use of e-resources, both the academic staff and postgraduate students concurred that adequate user skills were important. Several studies have highlighted users' awareness of the resources and the fact that search skills are often underdeveloped. Many of them are unable to find and download what they need (Harle, 2009; Bowe, 2014; Mugwisi, 2014; Richardson & Kennedy, 2014; Spiranec, Zorica & Kos, 2016).

7.4.5.5 High cost of internet access

A majority of academic staff and information specialists disagreed that high cost of internet access and lack of time were important factors influencing their non-use of e-resources contrary to the findings of the literature review (Research4Life, 2009; Ajuwon & Olorunsaye, 2013; Mugwisi, 2014; Dulle, 2015; Gaible, 2015).

7.4.5.6 Lack of to time search e-resources

As regards lack of time to search e-resources, a majority of the respondents indicated that they disagreed that lack of time to search e-resources influenced the non-use of e-resources by academic staff contrary to the literature review finding (Chisenga, 2004; Rosenberg, 2008).

7.4.6 Findings on effective promotion strategies to improve use of e-resources in STM disciplines at universities

The study established that (1) creating awareness using offline and online strategies to advertise newly acquired and available e-resources at the institutions (e.g. by using bulletins, newsletters, press statements, flyers, regular e-mail shots and journal indexing services); (2) building user skills on available databases and the use of database tools that enable setup of automated personalised selective dissermination of information tools like Google Alerts to keep users updated; (3) employing concerted efforts by both the library and academic staff to highlight the importance of using up to date information resources in research and assignments by students to encourage e-resources usage; and (4) the universities' continued investments in IT and internet infrastructure to ensure that available online platforms provided by the institutions support access to the e-resources and work well to encourage continued use by the users. Unreliable library online services discourage users.

7.5 LIMITATIONS OF STUDY

This study is limited to establishing the factors of use and non-use of free and discounted e-resources by academic staff and postgraduate students involved with the STM disciplines and information specialists involved with e-resources at the five selected universities in Zimbabwe. Although the study results will hold value for other developing countries, there may be some differences as well, given the economic and social differences in the countries.

The economic variations between the Sub-Saharan African countries is quite significant - with variations also evident in the tertiary education sectors in the countries (Teferra & Albach, 2004; Materu, 2007; Shabani, Okebukola & Oyewole, 2014). Hence the application of the relevance and recommendations of this study would be with some limitations. Findings cannot be generalised – but there is value as explained in section 7.6.

7.6 VALUE OF STUDY

An important finding of the current study was that it confirmed the assertion by Harle (2009) and the Association of Commonwealth Universities (2011) that the availability of journals is no longer the principal problem in academic institutions in Zimbabwe addressed by the low cost and free e-resources. The greater challenge is now to ensure that what is available can be accessed and is used to best effect. Access remains a problem for postgraduate students as confirmed by this study - and it probably may be correct with undergraduate students as well.

The study confirmed that lack of skills to use e-resources was indicated as a major factor influencing academic staff, students and information specialists not to use e-resources at the universities. It also confirmed that user awareness of available e-resources was an important factor that influenced the use of e-resources for academic staff and postgraduate students and that there was a deference of level of use of e-resources across STM disciplines.

The study confirmed that information searching skills influence the use of e-resources by academic staff and students. Training on the use of e-resources and experience have an impact on the use of the resources. The importance of training is thus supported.

The GLM analysis supported the notion that it was useful to establish the importance of factors identified in the literature review and during the empirical study; these impact on the information behaviour of academic staff and students. Thus, this study points to the barriers that need to be addressed most urgently to address the issues of access and use of e-resources at universities in Zimbabwe. Findings can guide information specialists in the strategies and type of interventions needed on e-resources at institutions with the aim of improving the use and uptake of the resources.

7.7 RECOMMENDATIONS FOR PRACTICE

Seven important areas emerged from this study that must be addressed as regards improving the use of e-resources by information specialists, academic staff and postgraduate students at universities, especially in a developing country such as Zimbabwe: i) creating awareness, ii) building user information skills through training on relevant e-resources and databases; iii) increasing information discoverability; iv) keeping the content relevant and up to date; v) providing technical support to e-resources users when they encounter problems; vi) ensuring adequate IT and Internet infrastructure at the universities; and vii) promoting the use of scholarly e-resources at the universities.

There are more but these are highlighted, because it is possible for libraries to address such issues.

7.7.1 Creating awareness

Training to develop and improve information literacy skills is essential for the effective use of e-resources. It, however, has limited value if not combined with raising awareness of such e-resources, and their value. The following specific suggestions are offered with regard to raising awareness.

- Develop effective and tailored marketing strategies to expose and highlight e-resources available and provided by the libraries to the user communities (information specialists, academics and students) in order to improve awareness about the resources through the use of online platforms, social media tools, seminars and skills building sessions (training) sessions at the universities.
- For academic staff, based on the findings that specific responsibilities such as research and supervision of students had the highest significance that affect their use of e-resources - they should be sensitised to link their responsibilities to see the value of e-resources in terms of responsibilities.
- Training should focus on all applicable functions and features provided by e-resources providers. For instance, Pharboo (2017) explained the value-added features and services of e-resources which might give insight into the usefulness of building skills on this aspect.

7.7.2 Building user information skills

Creating awareness on its own would not be enough - it has to be combined with building relevant information skills in order to improve the use of e-resources. This can be achieved through efforts such as:

- Regular training of users updating them on the database features and services that might help in the uptake and use of the resources and improve user search skills and general information skills.

- Reflection on factors influencing the use of e-resources and increasing the downloading of articles and how such factors might be exploited. Statistical inference findings indicated that if postgraduate students received training in the use of Google Scholar they are more inclined to download articles. Although downloading do not imply use, it might be a step in the right direction. It thus needs to be considered how training can guide students from this to effective use of e-resources such as databases.

7.7.3 Increasing information discoverability

The study shows that investments in improving training users and maketing available e-resources are important in order to improve accessibility and usage of the e-resources. However it is also important that users can easily find the available content through the e-resources. Content discoverabilty can be approached in more than one way:

- Lobbying for the service providers (e.g. database producers) to improve content discoverabilty and making user experiences more user-friendly.
- Improving library websites to provide easy access to e-resources and facilities to search across various e-resources e.g. through a discovery system or a federated search system (Shokouhi & Si, 2011).

7.7.4 Keeping the content relevant and up to date

A number of the points that were highlighted in the research findings, can be interpreted in terms of implications for library management as regards the content:

- Ensuring that the content to which the library subscribe is relevant
    - Selection of e-resources for the library collection
    - Working with different user groups to ensure collections of e-resources keep track of changes in content needs
    - Information specialists working with different user groups to explore relevant e-resources meeting with content needs and recognising changes in content needs
- Introducing current awareness services on specific e-resources including new e-books, saved searches on databases, journal table of contents using push technologies, etc..
- Adapting training styles and sessions e.g. runing regular training sessions to keep up with changes in databases functionality and services.

7.7.5 Ensuring adequate IT or internet and technical support to users of e-resources

According to the findings, access to computers and internet are no longer the key hinderances to access and use of e-resources. Just providing the e-resources and relevant IT or internet infrastructure would not be adequate if technical support services to maintain them are not provided. The findings show that the different user groups would use the e-resources more if they get relevant technical support when they encountered problems. This could include:

- Provision of timely troubleshooting services by the library and IT staff to support the users
- Addressing and resolving the technical problems that arise in a timely fashion to the satisfaction of the users.

7.7.6 Ensuring the provisions and maintenance of an appropriate IT infrastrure and access to IT required

Although lack of IT infrastructure and access to computers and the Internet are no longer the leading barriers in using e-resources, the situation in each university must be monitored on an ongoing basis, and precautions need to be taken where and when necessary.

7.7.7 Promoting the use of scholarly e-resources at the universities

Although raising awareness is a first step, it needs to be combined with effective strategies for the marketing and promotion of e-resources in academic contexts.

- Improved regular promotions of e-resources employing innovative strategies to reach the teaching, research and learning audiences at a university through effective promotions and campaigns to ensure user communities are aware and kept up to date with available resources, e.g.
    - The libraries providing lists of new journal articles and e-books that are distributed through a regular selective dissemination system to academic staff and postgraduate students differentiated by discipline and/or area of specialisation.
    - Exploring ways to provide information alert services (like Google Alerts) but automatically crawling the entire library’s e-journals and database collections customised for users at the university via the library website or institutional repositories (IR) at the universities.

7.8 RECOMMENDATIONS FOR THEORY

Although this study could have been stronger on the qualitative component, it was decided to focus on descriptive and inferential statistics as first round of exploration to identify issues that might also impact on e-resources use in academic contexts in developing as well as developed countries. For follow-up work the following recommendations are made from a theoretical perspective:

(1) Consideration of Bandura's social cognition and self-efficacy theory which holds that portions of an individual's knowledge acquisition can be directly related to observing others within the context of social interactions, experiences, and outside media influences (Bandura, 1977; Bandura, 2011). Often described as task-specific self-confidence, self-efficacy has been a key component in theories of motivation and learning in varied contexts (Artino, 2012). Further research focusing on establishing the impact of e-resources on information science professionals and academics' knowledge acquisition processes and behaviours leveraging on the improved information access is needed.

(2) Affordance theory originated in ecological psychology as the interaction between an actor with the environment, defined as the surroundings of the actor itself (Sadler & Given, 2007; Pozzi, Pigni & Vitari, 2014). Further research to establish use and non-use of e-resources in different environments by different academic user groups is needed to build the body of knowledge. Affordance theory might deepen insight in such a study.

(3) Principle of least effort, that postulates that animals, people, even well-designed machines will naturally choose the path of least resistance or effort. In information science, the principle states that an information-seeking client will tend to use the most convenient search method, in the least exacting mode available. Information seeking behaviour stops as soon as minimally acceptable results are found (Zipf, 1949; Fisher, 2005). Further research is needed to build on information seeking behaviour knowledge in digital academic environments focusing on information specialists, academic staff and students in developing country institutions, and the principle of least effort.

7.9 RECOMMENDATIONS FOR FURTHER RESEARCH

Further research should be undertaken to clarify the relationship between variables and each of the factors influencing the use and non-use of e-resources at universities in Zimbabwe, the information behaviour of academic staff, information specialists and postgraduate students. Specific areas of recommendation are important factors highlighted in this study, namely:

- The impact of disciplines on use of e-resources;
- The difference in use of e-resources by different user groups e.g. academic staff, postgraduate students and information specialists.
- The Net Generation impact; and
- The technology adoption factor by users.

More research is needed in establishing effective and innovative promotion strategies of library e-resources by university libraries in order to improve user access and use by academic staff and students especially at postgraduate level, e.g.

- Use of social media;
- Alignment with appropriate information literacy training;
- Differences ascribed to Net Generation use of scholarly electronic resources;
- Human functioning may be primarily influenced by personal (self-efficacy), behavioural (social recognition), and environmental (sense of cohesion in work area) influences (Alarcon, & Lyons, 2011). More work in the field of self-efficacy will enhance the understanding of how users use electronic resources and what the motivations are;
- The study of affordances advance research in the behavioural science domain, as well as the applied science domain (Nye & Silverman, 2012). In the behavioural sciences, affordances are used to study perceptual psychology, learning, and imitation. More research in this area will further clarify affordance theory and its applicability in the use of scholarly e-sources at academic institutions; and
- Information behaviour researchers focus on concepts relating to "principle of least effort" (Kim, 1982; Kebede, 2004; Harwood, 2009; Chang, 2016). Since the time of Zipf's classic 1949 book entitled *Human Behavior and the Principle of Least Effort* (HBPLE) on library and information science (LIS) research, continued to identify the influence of the main concepts in the theory (Chang, 2013). This theory holds true

regardless of the user's proficiency as a searcher, or their level of subject expertise (Bierbaum, 1990). This theory takes into account the user’s previous information-seeking experience. The user will use the tools that are most familiar and easy to use that find results (Bierbaum, 1990; Chang, 2013). Further indepth research on information seeking behaviour as it applies to academic staff and postgraduate students especially in low resourced environments in developing countries is important.

7.10 CONCLUSION

This study contributes to the growing body of literature that seeks to investigate and identify the important factors influencing the use and non-use of e-resources of academic staff and students at universities in developing countries, especially as it relates to universities in Zimbabwe.

The study has also provided useful information about information behaviour of academic staff and students in STM disciplines, and knowledge sharing behaviour in selected universities in Zimbabwe, which information can be used to inform further research, as well as professional practice by information specialists at the libraries. The study paved the way for further research.

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[16] First author name followed by *et al.* is used to denote more than three authors of an article or book in this bibliography

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APPENDIX 1: QUESTIONNAIRE FOR EACH PARTICIPATING LIBRARY:
LIBRARY HEADS/DIRECTORS OR THEIR REPRESENTATIVES

Respondent Number v0

The purpose of this study is to investigate the factors affecting the use and non-use of electronic information resources (e-resources) by academic staff and information specialists at universities in Zimbabwe involved with the scientific, technological and medical (STM) disciplines. The focus is on low-cost and free library e-resources. The purpose of this questionnaire is to collect data in order to establish these factors and contribute to the body of knowledge aimed at improving the use of library e-resources at the institution.

Your participation in the study is much appreciated.

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SECTION A: PROFILE OF THE LIBRARY

1. Indicate your university (v1)

Africa University (AU)	1
Chinhoyi University of Technology (CUT)	2
Midlands State University (MSU)	3
National University of Science and Technology (NUST)	4
University of Zimbabwe (UZ)	5

2. Indicate the STM disciplines that your library supports. (Please reply to all.)

	Yes	No	
Agriculture	1	2	v2a
Science and Technology	1	2	v2b
Medicine/Health	1	2	v2c
Environment	1	2	v2d
Natural Sciences	1	2	v2e
Other (please specify)	1	2	v2f

3. Indicate the number of library users _____ v3

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4. Indicate the number of library users who are academic staff _____ v4

5. Indicate the number of library staff _____ v5

6. Indicate the number of library staff who for the purposes of this study will qualify as information specialists _____ v6

(i.e. staff involved with one or more of the following activities related to electronic library resources: selection, subscription, training, marketing, advising on information searching, current awareness services and searching on behalf of library users)

SECTION B: LIBRARY COLLECTION

7. Indicate the number of items in your library for:

Print books		v7a
E-books		v7b
Journal titles (print only)		v7c
Journal titles (electronic only)		v7d
Theses/dissertations (print)		v7e
Theses/dissertations (electronic)		v7f

8. What is the library's budget for collection development for 2015? _______________ v8a
(Please indicate in dollars (USD).)

(This includes all information sources such as books, journals, videos, CDs and subscription to information resources such as databases.)

8.1 If you didn't indicate the library's budget in 8 above, please indicate why. v8b

No budget	1	
I don't know	2	
Other (please specify)		v8c

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9. Did your library's collection development budget increase or decrease from last year? (Please reply to all.)

	Yes	No	
Increased	1	2	v9a
Decreased	1	2	v9b
Stayed the same	1	2	v9c

9.1 If increased or decreased, please indicate the figure in USD. v9d

10. Which of the following electronic libray search tools are provided by the library? (Please reply to all.)

	Yes	No	
None of these	1	2	v10a
OPAC	1	2	v10a
Bibliographic, full-text & journal databases (e.g. Cab Abstracts, PubMed, Agricola, EBSCO Host, Emerald)	1	2	v10a
Institutional repository	1	2	v10a
Federated search engine or discovery tool (e.g. Libhub)	1	2	v10a

11. Which of the following databases does your library provide? (Please reply to all.)

	Yes	No	
AGORA	1	2	v11a
BioMed Central	1	2	v11b
Cab Abstracts	1	2	v11c
EBSCO Host	1	2	v11d
Emerald	1	2	v11e
HIGHWIRE	1	2	v11f
HINARI	1	2	v11g
JSTOR	1	2	v11h
OARE	1	2	v11i
PubMed	1	2	v11j
TEEAL	1	2	v11k
Other (please specify)			v11l

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12. In your opinion, how well does the library provide access to the full-text articles needed by users through the following?

	Very Poor	Poor	Fair	Good	Very good		
Print	1	2	3	4	5	12a	
Electronic	1	2	3	4	5	v12b	
Inter-library service	1	2	3	4	5	v12c	

13. Please give an estimation of the percentage of electronic databases that are available off campus. ___________ V13

SECTION C: INTERNET ACCESS IN THE LIBRARY

14. Are computers in the library reserved for specific user groups? (Tick all that apply.)

Yes	No		
1	2	v14	

14.1 If yes, please specify

	Yes	No		
Reserved for academic staff	1	2	v14a	
Reserved for postgraduate students	1	2	v14b	
Reserved for undergraduate students	1	2	v14c	

15. How many computers in the library offer internet access?

For library staff __________________ v15a

Overall for library users__________________ v15b

15.1 If reserved for specific user groups, how many computers with internet access are available for:

Academic staff ?________________________ v15c

Post-graduate students?__________________ v15d

Under-graduate students?__________________ v15e

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16. How do you rate the internet access speed in the library currently? v16

Very slow	Slow	Acceptable	Fast	Very fast
1	2	3	4	5

17. How reliable is internet access at the library (i.e. internet not being down)? v17

Very reliable	Reliable	Moderately reliable	Unreliable	Very unreliable
1	2	3	4	5

SECTION D: ACTUAL USE OF THE E-RESOURCES

18. How does the library provide/encourage access to electronic resources?
(Please respond to each question option.)

	Yes	No	
No efforts	1	2	v18a
Website with links to electronic resources (e.g. catalogue, databases, e-journals, e-books)	1	2	v18b
Faculty-specific information and guidelines on e-resources & information services	1	2	v18c
Discipline-specific information and guidelines on e-resources in STM disciplines	1	2	v18d
One-on-one training to library users	1	2	v18e
STM discipline-focused group training i.e. focusing on a specific discipline/s	1	2	v18f
Discipline-focused group training, but not for STM disciplines	1	2	v18g
All of the above	1	2	v18h

19. Please indicate the users at whom training is aimed. (Please reply to all.)

	Yes	No	
All staff	1	2	v19a
Academic staff	1	2	v19b
Post-graduate students	1	2	v19c
Under-graduate students	1	2	v19d

SECTION E: E-RESOURCES TRAINING

20. How has your library raised awareness of the use of e-resources in the past two years among academic staff?

Please respond to all options for raising awareness.)	Never	Rarely	Sometimes	Often	Always		
Posters and notice board signs	1	2	3	4	5	v20a	
Presentations	1	2	3	4	5	v20b	
Training workshops	1	2	3	4	5	v20c	
Individual orientation	1	2	3	4	5	v20d	
E-mail notification regarding e-resources	1	2	3	4	5	v20e	

21. Which methods, if any, has your library used in training on library e-resources? (Please reply to all.)

	Yes	No		
One-on-one	1	2	v21a	
Group	1	2	v21b	
Online	1	2	v21c	
None	1	2	v21d	

22. Has your library ever done surveys on satisfaction of academic staff regarding the availability of full-text articles?

Yes	No		
1	2	v22	

22.1 If yes, did you perhaps find any of the following? (Please reply to all.)

Lack of knowledge about e-resources available through the library

	Yes	No		
			v22a	
Lack of time to access e-resources	1	2	v22b	
No problems accessing e-resources	1	2	v22c	
Too few subscriptions in library for their research field	1	2	v22d	
Insufficient research relevant to the university's activities	1	2	v22e	
Not enough materials on local content in the library	1	2	v22f	
Internet connectivity limits use of online e-resources	1	2	v22g	
None of the above	1	2	v22h	
Other (please specify)			v22i	

23. Has your library ever done surveys on satisfaction of academic staff regarding the training on library e-resources? v23

Yes	No
1	2

23.1 If yes, did you perhaps find any of the following?

	Yes	No	
No time to attend training	1	2	V23a
Inadequate information about the training the library offers	1	2	v23b
Training by library does not address the needs of the academic staff	1	2	v23c
None of the above	1	2	v23d
Other (please specify)			v23e

24. What steps has your library taken to address problems noted/expressed in number 23? v24

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25. Is there any other information about the library's e-resources and especially the use of e-resources you would like to share? v25

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This concludes our questionnaire. Thank you again for your time and contribution.

APPENDIX 2:
QUESTIONNAIRE FOR INFORMATION SPECIALISTS RESPONSIBLE FOR E-RESOURCES IN THE LIBRARY

Respondent Number v0

The purpose of this study is to investigate the factors affecting the use and non-use of electronic information resources (e-resources) by academic staff and information specialists at universities in Zimbabwe involved with the scientific, technological and medical (STM) disciplines. The focus is on low-cost and free e-resources. The purpose of this questionnaire is to collect data in order to establish these factors and contribute to the body of knowledge to improve the use of library e-resources at the institutions.

For the purposes of this study, an information specialist is interpreted as a library staff member involved with one or more of the following activities related to e-resources: selection, subscription, training, marketing, advising on information searching, current awareness services and searching on behalf of library users. Your participation in the study is much appreciated.

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SECTION A: PARTICIPANT PROFILE

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1. Indicate your university — v1

Africa University (AU)	1
Chinhoyi University of Technology (CUT)	2
Midlands State University (MSU)	3
National University of Science and Technology (NUST)	4
University of Zimbabwe (UZ)	5

2. What is your age?_____years. — v2

3. What is your position in the library at your university? — v3

Top level (e.g. chief librarian, head librarian or library director)	1
Deputy level (e.g. deputy librarian)	2
Senior level (e.g. assistant librarian)	3
Junior level (e.g. library clerk)	4
Other (please specify)	5

4. How many years have you been working at the particular university?_______years. — v4

4.1 (If less than 1 year state number of months) _______ — v4a

5. How many years have you been working at another tertiary education institution in Zimbabwe in a similar capacity? (i.e. as a staff member of the library)_____years. — v5

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5.1 (If less than 1 year state number of months) _______ v5a

6. Tick the STM discipline in which you mostly provide information services. (Please reply to all.)

	Yes	No	
Agriculture	1	2	v6a
Science and Technology	1	2	v6b
Medicine/Health	1	2	v6c
Environmental Science	1	2	v6d
Natural Sciences	1	2	v6e
Veterinary Science	1	2	v6f
Other (please specify)	1	2	v6g

7. Tick the STM discipline in which you mostly teach information skills. (Please reply to all.)

	Yes	No	
Agriculture	1	2	v7a
Science and Technology	1	2	v7b
Medicine/Health	1	2	v7c
Environmental Science	1	2	v7d
Natural Sciences	1	2	v7e
Veterinary Science	1	2	v7f
None	1	2	v7g
Other (please specify)	1	2	v7h

8. In which subjects did you major in your degree studies? v8a

(Please write down the 3 specific major subjects you completed in the third year level of your qualification.) v8b

v8c

9. What is your highest qualification in library/information science? (Please mark only your highest qualification.)

No qualification in library/information science	1	v9
Certificate/diploma	2	
Bachelors degree	3	
Masters degree	4	
Doctoral degree	5	
Post-graduate diploma	6	

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QUESTIONNAIRE FOR INFORMATION SPECIALISTS RESPONSIBLE FOR E-RESOURCES IN THE LIBRARY

APPENDIX 2

10. Which of the following are included in your duties?	Yes	No	
Research	1	2	v10a
Teaching	1	2	v10b
Training	1	2	v10c
Outreach	1	2	v10d
None	1	2	v10e

SECTION B: INTERNET ACCESS

11. How do you access the internet? (Please reply to all.)	Yes	No	
Do not access the internet	1	2	v11a
Internet connection at home only	1	2	v11b
Internet connection at work only	1	2	v11c
Internet connection both at work and home	1	2	v11d
Internet café	1	2	v11e

12. Which type of device do you use to access the internet? (Please indicate the level of use for each.)

Desktop		%	v12a
Laptop		%	v12b
Tablet		%	v12c
Mobile phone		%	v12d
Other (please specifiy		%	v12e
Total	100	%	

SECTION C: LIBRARY E-RESOURCES

13. How often do you search library e-resources?

Never	1	v13
Rarely	2	
Sometimes	3	
Often	4	
Very often	5	

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QUESTIONNAIRE FOR INFORMATION SPECIALISTS RESPONSIBLE FOR E-RESOURCES IN THE LIBRARY

APPENDIX 2

14. How important is the use of library e-resources for you for the following?

	Not at all important	Low importance	Neutral	Important	Very important	
To find information on behalf of users	1	2	3	4	5	v14a
For study purposes	1	2	3	4	5	v14b
For teaching and study purposes	1	2	3	4	5	v14c

15. Please indicate how often you use the following e-resources.

	Never	Almost never	Once in while	Often	Very often	
AGORA	1	2	3	4	5	v15a
BioMed Central	1	2	3	4	5	v15b
Cab Abstracts	1	2	3	4	5	v15c
EBSCO Host	1	2	3	4	5	v15d
Emerald	1	2	3	4	5	v15e
HIGHWIRE	1	2	3	4	5	v15f
HINARI	1	2	3	4	5	v15g
JSTOR	1	2	3	4	5	v15h
OARE	1	2	3	4	5	v15i
PubMed	1	2	3	4	5	v15j
TEEAL	1	2	3	4	5	v15k

16. Why do you use e-resources for your work? (Please reply to all options.)	Yes	No	
I do not use e-resources for my work	1	2	v16a
To do searches on behalf of library users	1	2	v16b
To prepare for information literacy training	1	2	v16c
To support users with systematic literature reviews	1	2	v16d
To provide current awareness/alerting services to users	1	2	v16e
To run current awareness/alerting services for own benefit	1	2	v16f
To verify bibliographic detail	1	2	v16g
To prepare articles	1	2	v16h
To prepare papers for conferences	1	2	v16i
To write grant proposals	1	2	v16j
For collection building	1	2	v16k
For users' citation analysis	1	2	v16l
For tracking usage/logs	1	2	v16m
To assist under-graduate students	1	2	v16n

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QUESTIONNAIRE FOR INFORMATION SPECIALISTS RESPONSIBLE FOR E-RESOURCES IN THE LIBRARY

APPENDIX 2

17. Which of the following best reflects how frequently you download full-text articles from e-resources?
(Please mark the most appropriate from the following options).

	Never	Once	Several times		
				v17a	
Daily	1	2	3	v17b	
Weekly	1	2	3	v17c	
Monthly	1	2	3	v17d	

18. How would you rate your overall impression of the average speed of downloading an article from the internet at your library?

Very slow	Slow	Medium	Quick	Very quick		
1	2	3	4	5	v18	

SECTION D: FACTORS THAT INFLUENCE USE AND NON-USE

19. Please rate the impact of the following factors that influence you not to use e-resources. (Please reply to all factors.)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree		
Poor quality of internet connection that slows down speed						v19a	
Lack of access to computers						v19b	
Login/password to Research4Life programmes (AGORA, HINARI, OARE)						v19c	
Unavailability of full-text articles						v19d	
Too many steps required before getting a full-text article						v19e	
Lack of skills to use the e-resources						v19f	
Lack of technical support to solve access problems with available e-resources						v19g	
Language of publications e.g. mostly English						v19h	
Difficulty in finding relevant information						v19i	
High cost of internet access						v19j	
Lack of time to search e-resources						v19k	

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20. Please rate the impact of the following factors that influence you to use e-resources. (Please reply to all factors.)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
High quality of internet access providing a fast connection						v20a
Ease of use of e-resources e.g user-friendly interfaces						v20b
Availability of full-text articles						v20c
Good search skills						v20d
Training on use of e-resources						v20e
Experience in using e-resources						v20f
Good technical support when you encounter problems with the e-resources						v20g
Increase in quality research output required by the university						v20h
Low cost of internet access						v20i

21. Please indicate how the e-resources in your library meet your needs. (Please indicate response to all.)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
Type of materials covered						v21a
Scope of topics covered						v21b
Currency of materials (e.g. resources are up to date)						v21c
Availability of full text						v21d
Adequate organisation of resources						v21e
Relevance of resources to your research field or fields in which you support users						v21f
Ease of access to resources						v21g

SECTION E: E-RESOURCES TRAINING

22. What training have you received in the use of the e-resources that your library provides?	Yes	No	
No training received	1	2	v22a
Self-training for all e-resources	1	2	v22b
Self-training for some e-resources	1	2	v22c
In-house training for some e-resources	1	2	v22d
In-house training for all e-resources	1	2	v22e
Service provider training for some e-resources	1	2	v22f
Training by other third parties (e.g. workshops attended)	1	2	

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23. How would you rate your knowledge of searching the e-resources that your library provides?

Very poor	Poor	Average	Good	Excellent
1	2	3	4	5

v23

24. How would you rate your level of competence in using e-resources?

Very poor	Poor	Average	Good	Excellent
1	2	3	4	5

v24

25. How would you rate your level of competence in teaching users to find relevant information through the e-resources your library provides?

Very poor	Poor	Average	Good	Excellent
1	2	3	4	5

v25

26. Do you have other comments on the use of e-resources that have not been covered in this questionnaire?

v26

This concludes our questionnaire. Thank you again for your time and contribution.

APPENDIX 3:
QUESTIONNAIRE FOR ACADEMIC STAFF TEACHING IN SCIENTIFIC, TECHNOLOGICAL AND MEDICAL DISCIPLINES

Respondent Number v0

The purpose of this study is to investigate the factors affecting the use and non-use of electronic information resources (e-resources) by academic staff and information specialists at universities in Zimbabwe involved with the scientific, technological and medical (STM) disciplines.

The focus is on low-cost and free e-resources.

Your participation in the study is much appreciated.

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SECTION A: PARTICIPANT PROFILE

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1. Indicate your university

Africa University (AU)	1	v1
Chinhoyi University of Technology (CUT)	2	
Midlands State University (MSU)	3	
National University of Science and Technology (NUST)	4	
University of Zimbabwe (UZ)	5	

2. What is your age? _____ years. v2

3. What is your position in the faculty at your University?

Junior lecturer	1	v3
Lecturer	2	
Senior lecturer	3	
Associate professor	4	
Professor	5	
Other (please specify)		

4. How many years have you been working at the particular university? ______years. v4

4.1 (If less than 1 year state the number of months) ____ months v4a

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5 How many years have you been working at another tertiary education institution in Zimbabwe in a similar capacity?

(i.e as academic staff member involved in teaching in STM discipline) ____ years — v5

5.1 (If less than 1 year, state number of months)____ months — v5a

6. Tick the STM discipline that you teach in most of the time. (Please tick ONLY one.) — v6

Agriculture	1
Science and Technology	2
Medicine/Health	3
Environmental Science	4
Natural Sciences	5
Veterinary Science	6
Other (please specify)	

7. What is your highest qualification? (Please only mark the highest.) — v7

Bachelors degree	1
Honours degree	2
Masters degree	3
Doctoral degree	4
Post-graduate diploma	5
Other (please specify	

8. Please indicate what your duties involve and indicate the percentage of time spent on each per year.

Teaching/lecturing		%	v8a
Research (including publications and presentation)		%	v8b
Supervision of masters and/or doctoral students' research		%	v8c
Administration and other		%	v8d
Other (please specify)		%	v8e
Total	100%		

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QUESTIONNAIRE FOR ACADEMIC STAFF TEACHING IN SCIENTIFIC, TECHNOLOGICAL AND MEDICAL DISCIPLINES

APPENDIX 3

9. How many research papers or book chapters did you publish in the last 24 months?
(Please indicate the number for each publication type.)

Scholarly journals		v9a
Book chapters		v9b
Books		v9c
Patents		v9d
Conferences		v9e

SECTION B: INTERNET ACCESS

10. How do you access the internet? (Please reply to all.)	Yes	No	
Do not access the internet	1	2	v10a
Internet connection at home only	1	2	v10b
Internet connection at work only	1	2	v10c
Internet connection both at work and home	1	2	v10d
Internet café	1	2	v10e

11. Which type of device do you use to access the internet? (Please indicate the percentage level of use for each device.)

Desktop computer		%	v11a
Laptop		%	v11b
Tablet (e.g. iPad, Galaxy)		%	v11c
Mobile phone		%	v11d
Other (please specify)		%	v11e
Total	100%		

SECTION C: E- RESOURCES

12. Please indicate on a scale of 1-5 how often you use the following options to access the full text of journal articles and other research literature?

	Never	Almost never	Sometimes	Almost everytime	Everytime	
Search in the library catalogue	1	2	3	4	5	v12a
Databases (including e-journals and e-books)	1	2	3	4	5	v12b
Google Scholar	1	2	3	4	5	v12c
General search engines (e.g. Google, Bing)	1	2	3	4	5	v12d
Institutional repositories	1	2	3	4	5	v12e
Database for theses and dissertations	1	2	3	4	5	v12f

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13. Please indicate how often you use the following e-resources.

	Never	Almost never	Sometimes	Often	Very often		
AGORA	1	2	3	4	5	v13a	
BioMed Central	1	2	3	4	5	v13b	
Cab Abstracts	1	2	3	4	5	v13c	
EBSCO Host	1	2	3	4	5	v13d	
Emerald	1	2	3	4	5	v13e	
HIGHWIRE	1	2	3	4	5	v13f	
HINARI	1	2	3	4	5	v13g	
JSTOR	1	2	3	4	5	v13h	
OARE	1	2	3	4	5	v13i	
PubMed	1	2	3	4	5	v13j	
TEEAL	1	2	3	4	5	v13k	

14. How often do you use the following e-resources?

	Never	Almost never	Once in a while	Often	Very often		
To prepere for teaching students	1	2	3	4	5	v14a	
To run current awareness/ alerting services for my own benefit	1	2	3	4	5	v14b	
To verify bibliographic detail	1	2	3	4	5	v14c	
To prepare articles	1	2	3	4	5	v14d	
To prepare papers for conferences	1	2	3	4	5	v14e	
To write grant proposals	1	2	3	4	5	v14f	
Other (please specify)	1	2	3	4	5	v14g	

15. Which of the following best reflect how frequently you download full-text articles?

	Never	Once	Several times		
Daily	1	2	3	v15a	
Weekly	1	2	3	v15b	
Monthly	1	2	3	v15c	

16. How would you rate your overall impression of the speed of downloading articles from the Internet?

Very slow	Slow	Medium	Quick	Very quick		
1	2	3	4	5	v16	

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17. Approximately how many electronic journal articles on average do you download per year? v17

18. Approximately how many journal articles do you locate in print/hard copy per year? v18

SECTION D: FACTORS AFFECTING THE USE AND NON-USE OF E-RESOURCES

19. Please rate the impact of the following factors that influence you not to use e-resources.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
Lack of access to computers						v19a
Limited access to the internet (e.g. because of high cost of internet access)						v19b
Unreliable/slow internet access						v19c
User authentication e.g. login ID/password						v19d
Unavailability of electronic full-text articles						v19e
Too many steps required before getting a full-text article						v19f
Lack of skills to use the e-resources						v19g
Lack of technical support to solve access problems with e-resources						v19h
Language of publications e.g. mostly English						v19i
Lack of time to search e-resources						v19j

20. Please rate the impact of the following factors that influence you to use e-resources. (Please reply to all factors.)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
Ease of use of e-resource e.g user-friendly interfaces						v20a
Good search skills						v20b
Training on use of e-resources						v20c
Experience in using e-resources						v20d
Good technical support when you encounter problems with the e-resources						v20e
Increase in quality research output required by the university						v20f
Low cost of internet access						v20g

20. Please rate the impact of the following factors that influence you to use e-resources. (Please reply to all factors.)

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree		
Ease of use of e-resource e.g user-friendly interfaces						v20a	
Good search skills						v20b	
Training on use of e-resources						v20c	
Experience in using e-resources						v20d	
Good technical support when you encounter problems with the e-resources						v20e	
Increase in quality research output required by the university						v20f	
Low cost of internet access						v20g	

21. Please indicate how well the e-resources provided by your library meet your needs in terms of the following: (Please reply to all factors).

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree		
Type of materials covered						v21a	
Scope of topics covered						v21b	
Currency of materials (e.g. are resources are up to date?)						v21c	
Availability of full text						v21d	
Relevance to your research objectives and field(s)						v21e	
Ease of access to full text						v21f	

22. I would be more likely to use e-resources for research purposes if:

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree		
I knew more about e-resources available at my institution						v22a	
My library would train me on using e-resources						v22b	
I had better access to databases that I need at my institution						v22c	
Electricity supply was more stable at my institution						v22d	
I had stable internet access at my institution						v22e	
There were no restriction on internet access at the institution						v22f	
Internet connectivity from home was cheaper						v22g	

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23. What training have you received from your library in the use of e-resources?

	Yes	No		
Databases	1	2	v23a	
E-journals	1	2	v23b	
Google Scholar	1	2	v23c	
Other (please specify)			v23d	

24. Please rate your skills in using databases.

	Very poor	Poor	Fair	Good	Very good		
Google Scholar	1	2	3	4	5	v24a	
Cab abstracts	1	2	3	4	5	v24b	
Pubmed	1	2	3	4	5	v24c	

25. Do you have other comments on the use of e-resources that have not been covered in this questionnaire? (Please specify.) v25

This concludes our questionnaire. Thank you again for your time and contribution.

APPENDIX 4:
QUESTIONNAIRE FOR: POST-GRADUATE STUDENTS IN SCIENTIFIC, TECHNOLOGICAL AND MEDICAL DISCIPLINES

Respondent Number v0

The purpose of this study is to investigate the factors affecting the use and non-use of electronic information resources (e-resources) by academic staff and information specialists at universities in Zimbabwe involved with the scientific, technological and medical (STM) disciplines. The focus is on low-cost and free e-resources.

The purpose of this questionnaire is to collect data in order to establish these factors and contribute to the body of knowledge to improve the use of library e-resources at the institutions.

Your participation in the study is much appreciated.

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SECTION A: PARTICIPANT PROFILE

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1. Indicate your university

Africa University (AU)	1	v1
Chinhoyi University of Technology (CUT)	2	
Midlands State University (MSU)	3	
National University of Science and Technology (NUST)	4	
University of Zimbabwe (UZ)	5	

2. What is your age? _____ years. v2

3. Indicate your faculty

Agriculture	1	v3
Science and Technology	2	
Medicine/Health	3	
Environmental Science	4	
Natural Sciences	5	
Veterinary Science	6	
Other (please specify)		

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4. What is your degree programme?

Post-graduate (MSc/MPhil)	1	v4
Post-graduate (PhD/DPhil)	2	
Other (please specify)		

5. At what level are you in your post-graduate studies?

1st year	1	v5
2nd year	2	
3rd year	3	
4th - 5th year	4	
Other (please specify)		

6. How many research papers or book chapters did you publish in the last 24 months?
(Please indicate the number for each publication type.)

Scholarly journals		v6a
Book chapters		v6b
Books		v6c
Patents		v6d
Conferences		v6e

SECTION B: INTERNET ACCESS

7. How do you access the internet? (Please mark the most appropriate option).	Yes	No	
Do not access the internet	1	2	v7a
Internet connection at home only	1	2	v7b
Internet connection at work only	1	2	v7c
Internet connection both at work and home	1	2	v7d
Internet café	1	2	v7e

8. Which type of device do you use to access the internet? (Please indicate the percentage level of use for each device).

Desktop computer		%	v8a
Laptop		%	v8b
Tablet (e.g. iPad, Galaxy)		%	v8c
Mobile phone		%	v8d
Other (please specify)		%	v8e
Total	100%		

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QUESTIONNAIRE FOR POST-GRADUATE STUDENTS IN SCIENTIFIC, TECHNOLOGICAL AND MEDICAL DISCIPLINES

APPENDIX 4

SECTION C: E- RESOURCES

9. Please indicate on a scale of 1-4 how often you use the following options to access the full text of journal articles and other research literature?

	Never	Almost never	Sometimes	Often	Very often		
Search in the library catalogue	1	2	3	4	5	v9a	
Databases (including e-journals and e-books	1	2	3	4	5	v9b	
Google Scholar	1	2	3	4	5	v9c	
General search engines (e.g. Google, Bing)	1	2	3	4	5	v9d	
Institutional repositories	1	2	3	4	5	v9e	
Database for thesis and dissertations	1	2	3	4	5	v9f	

10. Please indicate how often you use the following e-resources.

	Never	Almost never	Sometimes	Often	Very often		
AGORA	1	2	3	4	5	v10a	
BioMed Central	1	2	3	4	5	v10b	
Cab Abstracts	1	2	3	4	5	v10c	
EBSCO Host	1	2	3	4	5	v10d	
Emerald	1	2	3	4	5	v10e	
HIGHWIRE	1	2	3	4	5	v10f	
HINARI	1	2	3	4	5	v10g	
JSTOR	1	2	3	4	5	v10h	
OARE	1	2	3	4	5	v10i	
PubMed	1	2	3	4	5	v10j	
TEEAL	1	2	3	4	5	v10k	

11. How often do you use the following e-resources?

	Never	Almost never	Sometimes	Often	Very often		
To prepere for teaching students	1	2	3	4	5	v11a	
To run current awareness/alerting services for my own benefit	1	2	3	4	5	v11b	
To verify bibliographic detail	1	2	3	4	5	v11c	
To prepare articles	1	2	3	4	5	v11d	
To prepare papers for conferences	1	2	3	4	5	v11e	
To write grant proposals	1	2	3	4	5	v11f	
Other (please specify)	1	2	3	4	5	v11g	

12. Which of the following best reflect how frequently you download full-text articles from e-resources?

(Please mark the most appropiate from the following options).

	Never	Once	Several times	
Daily	1	2	3	v12a
Weekly	1	2	3	v12b
Monthly	1	2	3	v12c
Never	1	2	3	v12d

13. How would you rate your overall impression of the speed of downloading articles from the Internet?

Very slow	Slow	Medium	Quick	Very quick	
1	2	3	4	5	v13

14. Approximately how many electronic journal articles on average do you download per year? v14

15. Approximately how many journal articles do you locate in print/hard copy per year? v15

SECTION D: FACTORS AFFECTING THE USE AND NON-USE OF E-RESOURCES

16. Please rate the impact of the following factors that influence you not to use e-resources. (Please reply to all factors).

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
Lack of access to computers						v16a
Limited access to the internet (e.g. because of high cost of internet access)						v16b
Unreliable/slow Internet access						v16c
User authentication e.g. login ID/password						v16d
Unavailability of electronic full-text articles						v16e
Too many steps required before getting a full-text article						v16f
Lack of skills to use the e-resources						v16g
Lack of technical support to solve access problems with e-resources						v16h
Language of publications e.g. mostly English Lack of time to search e-resources						v16i

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17. Please rate the impact of the following factors that influence you to use e-resources. (Please reply to all factors).

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
Ease of use of e-resource e.g user-friendly interfaces						v17a
Good search skills						v17b
Training on use of e-resources						v17c
Experience in using e-resources						v17d
Good technical support when you encounter problems with the e-resources						v17e
Increase in quality research output required by the university						v17f
Low cost of internet access						v17g

18. Please indicate how well the e-resources provided by your library meet your needs in terms of the following. (Please reply to all factors).

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
Type of materials covered						v18a
Scope of topics covered						v18b
Currency of materials (e.g. are resources up to date?)						v18c
Availability of full text						v18d
Relevance to your research objectives and field(s)						v18e
Ease of access to full text						v18f

19. I would be more likely to use e-resources for research purposes if:

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree	
I knew more about e-resources available at my institution						v19a
My library would train me on using e-resources						v19b
I had better access to databases that I need at my institution						v19c
Electricity supply was more stable at my institution						v19d
I had stable internet access at my institution						v19e
There were no restriction on internet access at the institution						v19f
Internet connectivity from home was cheaper						v19g

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QUESTIONNAIRE FOR POST-GRADUATE STUDENTS IN SCIENTIFIC, TECHNOLOGICAL AND MEDICAL DISCIPLINES

APPENDIX 4

SECTION E: E-RESOURCES TRAINING

20. What training have you received from your library in the use of e-resources?

	Yes	No		
Databases	1	2	v20a	
E-journals	1	2	v20b	
Google Scholar	1	2	v20c	
Other (please specify)			v20d	

21. Please rate your skills in using databases

	Very Poor	Poor	Fair	Good	Very good		
Google Scholar	1	2	3	3	5	v21a	
Cab abstracts	1	2	3	3	5	v21b	
Pubmed	1	2	3	3	5	v21c	

22. Do you have other comments on the use of e-resources that have not been covered in this questionnaire? (Please specify) v22

This concludes our questionnaire. Thank you again for your time and contribution.

Appendix 5: Study Approval Letter from University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Reference number: EBIT/9/2015 24 February 2014

Mr G Chimwaza
P O Box 11632
Die Hoewes
0163

Dear Mr Chimwaza,

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Ethics Committee refers.

1 I hereby wish to inform you that the research project titled "Factors affecting the use and non-use of electronic information resources (e-resources) by academic and information specialists in Scientific, Technology and Medical (STM) disciplines at universities in Zimbabwe: a focus on low cost and free information resources" has been approved by the Committee.

This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Codes of Research Ethics of the University of Pretoria, if action is taken beyond the approved proposal.

2 According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of any member of the Faculty Committee who will deal with the matter.

3 The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof JJ Hanekom
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

Appendix 6: Authorisation Letter from Chinhoyi University of Technology

Chinhoyi University of Technology
P Bag 7724
Chinhoyi
Zimbabwe

October 13, 2014

Gracian Chimwaza
P.O. Box 11632, Die Hoewes,
Centurion 0163
South Africa

Re: Chinhoyi University of Technology: Doctoral study permission confirmation

Dear Mr. Gracian Chimwaza,
I acknowledge your request and grant you permission to conduct your study with the Chinhoyi University of Technology staff for your doctoral study titled, *Factors affecting the use and non-use of electronic library resources (e-resources) by academic staff and information specialists in Scientific, Technological and Medical (STM) disciplines at universities in Zimbabwe.*

I will be happy to assist wherever possible with your investigation and look forward to also learning about the study findings through your thesis.

Yours sincerely,

B Nyagwaya
Acting Librarian

Appendix 7: Authorisation Letter from National University of Science and Technology

National University of Science and Technology
P. O. Box AC 939, Bulawayo, Zimbabwe
Cnr. Gwanda Road/Cecil Avenue
Telephone: 263-9-282842/288413/39/58
Fax: 263-9-289057

From Registrar F. Mhlanga Dip Edu, BEd, MSc(UZ); MBA (NUST)

27 October 2014

Gracian Chimwanza
P O Box 11632, Die Hoewes
Centurion 0163
SOUTH AFRICA

Dear Mr Chimwanza

RE: NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY NUST: DOCTORAL STUDY PERMISSION CONFIRMATION

We acknowledge your request and grant you permission to conduct your study at the National University of Science and Technology for your doctoral study titled "**Factors affecting the use and non-use of electronic library resources (e-resources) by academic staff and information specialists in Scientific, Technological and Medical (STM) disciplines at universities in Zimbabwe**".

We will be happy to assist wherever possible with your investigation and look forward to also learning about the study findings through your thesis.

We would like to emphasize that all the information gathered should be for research purposes only and that confidentiality, where necessary, has to be exercised.

The University wishes you all the best in your research.

Yours sincerely

F Mhlanga
REGISTRAR

cc NUST Librarian

NATIONAL UNIVERSITY
OF SCIENCE AND TECHNOLOGY
REGISTRAR
2014 -10- 28
P.O. BOX AC 939, ASCOT
BULAWAYO