

AN ASSESSMENT OF OPEN SOURCE PROMOTION IN
ADDRESSING ICT ACCEPTANCE CHALLENGES IN TANZANIA

by

JOSEPHAT KINYONDO

submitted in accordance with the requirements for

the degree of

MASTER OF SCIENCE

in the subject

INFORMATION SYSTEMS

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROF JUDY VAN BILJON

CO-SUPERVISOR: PROF AURONA GERBER

February, 2012

Student number: 45935696

I declare that An assessment of Open Source Promotion in Addressing ICT Acceptance Challenges in Tanzania is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

A handwritten signature in blue ink, consisting of a stylized 'D' followed by a series of loops and a horizontal line.

SIGNATURE

DATE 24-02-2012

UMI

MASTERS THESIS

PUBLISH ABSTRACT ONLY AGREEMENT

PERSONAL DATA

1. Last Name First Name Middle Name
KINYONDO JOSEPHAT RUTAIHWA

2. Year of Birth (Optional) 3. Country of Citizenship
1982 TANZANIA

3. Present Mailing Address

Street address:

UBUNGO KIBANGU, DAR ES SALAAM

City State/Province Postal code Country
DAR ES SALAAM TANZANIA

E-mail address:

josephatk@hotmail.com

MASTER'S DEGREE DATA

4. Full name of university conferring degree, and college or division if appropriate
UNIVERSITY OF SOUTH AFRICA

5. Abbreviation for degree awarded 7. Year degree awarded
MSC INFORMATION SYSTEMS 2012

M(I)
PAO
2012

**Do not write in
this space**

Vol/Issue

School Code

TITLE/SUBJECT AREA

6. Enter the title of thesis. If thesis is written in a language other than English, please specify which language and translate title into English.

Language of text: ENGLISH

Title: AN ASSESSMENT OF OPEN SOURCE PROMOTION IN ADDRESSING ICT ACCEPTANCE CHALLENGES IN TANZANIA

7. Subject category of thesis. Please enter four-digit code from “Subject Categories” on following page. 0790

8. ABSTRACT:

Developing countries like Tanzania experience challenges towards utilization and acceptance of ICT; calling for a need to further research on the concept. Open Source (OS) usage is a potential strategy for addressing such challenges. However, the success of this strategy strongly relies on the strength of the promotional efforts. The study, therefore aims at assessing the OS promotional efforts in relation to ICT acceptance challenges in Tanzania.

This study entailed a descriptive, mixed-methods research. A literature analysis, document analysis and observations of OS community activities were conducted in order to list the ICT acceptance challenges. The results formed a basis for survey and interview questions. The findings obtained were triangulated to determine the existing OS promotional activities and assess the effectiveness of the promotional efforts in addressing ICT acceptance challenges in Tanzania.

The study also makes recommendations on how OS promotional efforts should be changed to improve their effectiveness.

Author Signature: 

Date: 24-02-2012

ACKNOWLEDGEMENT

The successful completion of this study would not have been possible had it not been for the many blessings I received from a good number of people. First and foremost my greatest gratitude is to the almighty God, who is the source of all my strength.

My sincere gratitude goes to my supervisor, Prof. Judy Van Biljon and the co-supervisor, Prof. Auroa Gerber, for their constant support and tireless efforts in shaping and perfecting my work so that it reaches the required standards. Their constructive criticism and moral and professional support have significantly facilitated the successful completion of this work.

I appreciate the contribution of all the participants who showed support and collaborated with me in providing the data I needed for my research. Despite the distance and the geographical limitations, they ensured their online availability and never hesitated to communicate information that was necessary for this research work.

I am greatly indebted to UNISA through the Student Funding Department for their financial support that was always timely approved by the department. The kindness shown by the department motivated me to work even harder during challenging times when I thought my work would never come to an end.

I wish to express my sincere appreciation to my brother, Faith, and his family for accommodating me during my stay in South Africa as I attended meetings with my supervisors. My deepest thanks go to my friend, Benedict Lema, for reviewing and editing my language.

Last, but not least, I would like to thank the people who are dear to me. They include my loving mother, Paskazia Kinyondo, for her constant prayers and moral support, my lovely fiancée Martina Komba, for her constant support, advice and encouragement, my aunt, Dr Godbertha Kinyondo, for her professional advice and my sister, Sylvia Kinyondo, for her encouragement and prayers despite the distance.

Table of Contents

| | |
|---|----|
| ACKNOWLEDGEMENT | 5 |
| LIST OF TABLES | 11 |
| LIST OF FIGURES | 13 |
| ABSTRACT | 15 |
| GLOSSARY OF TERMS | 16 |
| CHAPTER ONE: INTRODUCTION..... | 18 |
| 1.1 Introduction..... | 18 |
| 1.2 Features of developing countries | 18 |
| 1.3 Defining open source (OS) | 20 |
| 1.4 Features of open source | 21 |
| 1.5 Worldwide use of open source (OS)..... | 22 |
| 1.6 Background to the problem..... | 23 |
| 1.7 Statement of the problem | 25 |
| 1.8 Research objectives..... | 25 |
| 1.8.1 General objective | 25 |
| 1.8.2 Specific objectives | 25 |
| 1.9 Research questions..... | 26 |
| 1.10 Scope, assumptions and limitations | 27 |
| 1.10.1 Assumptions..... | 27 |
| 1.10.2 Scope..... | 27 |
| 1.10.3 Limitations | 28 |
| 1.11 Organisation of the study | 28 |

| | |
|--|----|
| CHAPTER TWO: LITERATURE REVIEW | 30 |
| 2.1 Introduction..... | 30 |
| 2.2 ICT acceptance challenges..... | 30 |
| 2.3 Technology acceptance models | 33 |
| 2.3.1 Technology Acceptance Model (TAM)..... | 34 |
| 2.3.2 TAM 2..... | 35 |
| 2.3.3 TAM 3..... | 37 |
| 2.3.4 TAM extensions..... | 39 |
| 2.3.5 Unified Theory of Acceptance and Use of Technology (UTAUT) | 40 |
| 2.3.6 ASA approach to technology acceptance | 42 |
| 2.3.7 Task–Technology Fit (TTF) | 43 |
| 2. 4 Historical background of open source | 44 |
| 2.5 Open source promotion..... | 46 |
| 2.5.1 Formation of open source communities..... | 46 |
| 2.5.2 Community collaborative tools..... | 49 |
| 2.5.3 Promotion with government support | 51 |
| 2.5.4 Promotion by private firms | 54 |
| 2.6 Determining the gap..... | 56 |
| 2.7 Summary | 56 |
| CHAPTER THREE: RESEARCH METHODOLOGY | 57 |
| 3.1 Introduction..... | 57 |
| 3.2 Research design | 57 |
| 3.2.1 Research approaches | 58 |
| 3.2.2 Research strategies..... | 58 |

| | |
|--|----|
| 3.3 Data collection | 66 |
| 3.3.1 Data collection techniques | 66 |
| 3.4 Research methods and design applied to this study | 68 |
| 3.5 Summary | 71 |
| CHAPTER FOUR: ICT ACCEPTANCE CHALLENGES..... | 74 |
| 4.1 Introduction..... | 74 |
| 4.2 Overview of the theoretical technology models | 75 |
| 4.3 Technology acceptance model on open source..... | 76 |
| 4.4 List of ICT acceptance challenges in Tanzania | 79 |
| 4.4.1 Donor dependency | 79 |
| 4.4.2 Lack of ICT experts | 80 |
| 4.4.3 Culture..... | 80 |
| 4.4.4 Low income and cost | 80 |
| 4.4.5 Lack of ICT awareness, poor information and illiteracy | 81 |
| 4.5 Open source and ICT acceptance challenges..... | 82 |
| 4.5.1 Open source and ICT skills..... | 82 |
| 4.5.2 Open source and private sector support | 83 |
| 4.5.3 Open source, government commitment and language | 84 |
| 4.5.4 Open source and cost | 85 |
| 4.6 Summary | 86 |
| CHAPTER FIVE: DATA CAPTURING CONTEXT..... | 87 |
| 5.1 Introduction..... | 87 |
| 5.2 Sampling | 90 |
| 5.2.1. Sampling of participants and execution of the survey | 92 |

| | |
|---|-----|
| 5.2.2 Sampling of participants in the interviews..... | 94 |
| 5.3 Document analysis | 95 |
| 5.3.1 Case study 1: Tanzania Free and Open Source Software Association (TAFOSSA)... | 95 |
| 5.3.2 Case study 2: Tanzania Linux User Group (TLUG)..... | 96 |
| 5.3.3 Case study 3: Kilinux..... | 97 |
| 5.3.4 Case study 4: Tanzania Ubuntu Association | 97 |
| 5.3.5. Case study results..... | 98 |
| 5.4 Observation | 99 |
| 5.5 Summary | 99 |
| CHAPTER SIX: DATA ANALYSIS AND FINDINGS..... | 101 |
| 6.1 Introduction..... | 101 |
| 6.2 Data analysis | 102 |
| 6.2.1 ICT acceptance challenges in Tanzania..... | 102 |
| 6.2.2 Promotion of open source | 109 |
| 6.2.3 The success of open source promotion in addressing ICT acceptance challenges | 112 |
| 6.3 Discussion of the findings..... | 123 |
| 6.3.1 ICT acceptance challenges in Tanzania..... | 123 |
| 6.3.2 Open source promotional activities | 124 |
| 6.3.3 The success of open source promotion in addressing ICT acceptance challenges | 127 |
| 6.4 Conclusion | 130 |
| CHAPTER SEVEN: CONCLUSION AND CONTRIBUTIONS..... | 132 |
| 7.1 Introduction..... | 132 |
| 7.2 Research questions revisited..... | 133 |
| 7.3 Synthesis of the findings in relation to the research questions | 135 |

| | |
|---|-----|
| 7.4 Study limitations | 136 |
| 7.5 Study contributions and contextualisation | 137 |
| 7.6 Recommendations | 137 |
| 7.7 Reflections | 139 |
| 7.8 Further research | 139 |
| 7.9 Conclusion | 139 |
| REFERENCES | 143 |
| Appendix 1 Ethical clearance approval | 166 |
| Appendix 2: Questionnaire on open source | 167 |
| Appendix 3 Interview questions | 174 |
| Appendix 4: Quantitative data captured in response to the survey..... | 175 |

LIST OF TABLES

| | |
|---|-----|
| Table 1.1 Characteristics of open source | 22 |
| Table 2.1 Determinants of perceived usefulness identified in TAM 2..... | 36 |
| Table 2.2 Determinants of perceived ease of use | 38 |
| Table 2.3 Open source community stakeholders | 47 |
| Table 2.4 Examples of open source communities | 48 |
| Table 2.5 Some collaborative tools of open source | 49 |
| Table 2.6 Government involvement in open source promotion..... | 53 |
| Table 2.7 Open source practitioners | 55 |
| Table 3.1 Relationship between research questions, objectives and activities..... | 71 |
| Table 4.1 ICT acceptance challenges in Tanzania moderators, determinants and models..... | 78 |
| Table 5.1: Objectives, research activities and tools | 89 |
| Table 5.2: Respondents by gender..... | 90 |
| Table 5.4: Survey respondents by OS facility | 92 |
| Table 5.5: Interview participants by OS facility | 94 |
| Table 6.1: Mapping research objectives to research output | 102 |
| Table 6.2: Interview results on selected ICT acceptance challenges..... | 103 |
| Table 6.3 Distribution of OS promotion efforts based on surveys..... | 109 |
| Table 6.4 Distribution of OS promotion efforts based on interviews..... | 110 |
| Table 6.5: Skills (Item 18-20 of Questionnaire)..... | 114 |
| Table 6.6: Vendor Dependency (Items 14-17 of Questionnaire)..... | 117 |
| Table 6.7: OS awareness (Items 21-23 of Questionnaire)..... | 118 |
| Table 6.8: Government and private sector support (items 29-32 of questionnaire)... | 122 |

Table 7.1 Summary of the research design.....135

LIST OF FIGURES

| | |
|---|-----|
| Figure 1.1: Chapter map for the research..... | 29 |
| Figure 2.1: Discussion flow for chapter 2 | 30 |
| Figure 2.2: internet Usage in Tanzania (2000-2007) | 33 |
| Figure 2.3: Technology acceptance model (TAM) by Davis 1986/89 | 35 |
| Figure 2.4: TAM as extended by Lee and Cole 2003..... | 39 |
| Figure 2.5: Unified theory of acceptance and use of technology (UTAUT) by Venkatesh and Massingue (2003)..... | 41 |
| Figure 2.6: The ASA approach as per Verde gem et al, 2008 | 42 |
| Figure 2.7: The task-technology fit model | 43 |
| Figure 3.1: Chapter Map..... | 57 |
| Figure 4.1: Discussion flow for Chapter 4 | 74 |
| Figure 4.2: Graphical overview of the models studied | 75 |
| Figure 4.3: TAM for OS..... | 77 |
| Figure 5.1: Discussion flow for Chapter 5 | 87 |
| Figure 5.2: TAFOSSA emblem..... | 95 |
| Figure 5.3: TLUG emblem | 94 |
| Figure 5.4: Kilinux Emblem | 95 |
| Figure 6.1: Discussion flow for Chapter 6 | 99 |
| Figure 6.2: Major ICT acceptance challenges in Tanzania | 103 |
| Figure 6.3: OS perceived positive features in percentage as per survey | 113 |
| Figure 6.4: OS perceived positive features in percentage as per interview..... | 114 |
| Figure 6.5a Graphical presentation of Skills level category..... | 115 |
| Figure 6.5b: Online contributions | 115 |

| | |
|--|-----|
| Figure 6.5b ICT skills mostly addressed in online forums | 116 |
| Figure 6.6 OS Reliability | 117 |
| Figure 6.7: Extent of external partnership | 119 |
| Figure 6.8: Success of seminars and workshops | 120 |
| Fig 6.9: OS addressing product maintenance and training cost | 121 |
| Fig 6.10: OS addressing product distribution cost | 121 |
| Fig 6.11: Graphical presentation of private sector category | 122 |
| Figure 7.1: Discussion flow for Chapter 7 | 132 |

ABSTRACT

Developing countries like Tanzania experience challenges towards utilization and acceptance of ICT; calling for a need to further research on the concept. Open Source (OS) usage is a potential strategy for addressing such challenges. However, the success of this strategy strongly relies on the strength of the promotional efforts. The study, therefore aims at assessing the OS promotional efforts in relation to ICT acceptance challenges in Tanzania.

This study entailed a descriptive, mixed-methods research. A literature analysis, document analysis and observations of OS community activities were conducted in order to list the ICT acceptance challenges. The results formed a basis for survey and interview questions. The findings obtained were triangulated to determine the existing OS promotional activities and assess the effectiveness of the promotional efforts in addressing ICT acceptance challenges in Tanzania.

The study also makes recommendations on how OS promotional efforts should be changed to improve their effectiveness.

Keywords

Open source; information; communication technology; promotion

GLOSSARY OF TERMS

- 1. ICT** – Information and communications technology comprises the use of hardware, software, services and supporting infrastructure to capture, process, store, manage and disseminate information.
- 2. OS** – open source is defined as any ICT software that is created in a collaborative way such that the software is open to the public without any interference from the developer of the program, and the developed software is transferable and open to modification to suit different demands.
- 3. Challenges** – A combination of factors that poses an obstacle, which tends to prevent action or slows down progress.
- 4. ICT challenges** – A combination of factors that poses an obstacle that tends to prevent the design, development and implementation of ICT, as well as social, political, cultural and economic factors that hinder firmly established and accepted practices or procedures of ICT usage.
- 5. ICT acceptance challenges** – A combination of factors that poses an obstacle that tends to prevent the willingness of a user or user group to employ ICT for the tasks it was designed to support. ICT challenges is a broader notion than ICT acceptance challenges and in this study ICT acceptance challenges are regarded as a subset of ICT challenges.
- 6. Usage** – Firmly established and generally accepted practice or procedure
- 7. ICT usage** – Established and generally accepted practices of ICT that enhance economic development. *For this study it is assumed that ICT acceptance is a prerequisite for ICT usage and ICT usage therefore implies ICT acceptance.*
- 8. OS promotion** – OS promotion refers to both the attempt and the activities embarked on to make practitioners and the general public aware of the existence of OS and the merits associated with its use.
- 9. User acceptance** – User acceptance is the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support.

10. OS acceptance – OS acceptance is the demonstrable willingness within a user group to employ OS software for the tasks it was designed to support.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

It is accepted that open source (OS) software has the potential to address the information and communications technology (ICT) acceptance challenges in developing countries (Chonia 2003; Van Belle and Ellis 2009). However, to ensure the acceptance of OS as a strategy in addressing ICT acceptance challenges, OS has to be promoted effectively. It is therefore important to gain some understanding of the features of developing countries and the features of OS before we formalise the problem statement. This introductory chapter provides a brief overview of the study in terms of the aim of the study, the research questions, the rationale and the context for the investigation. The aim of this study is to assess OS promotional efforts as a strategy to address ICT acceptance challenges in Tanzania.

Section 1.2 presents the features of developing countries in general and the status of ICT in developing countries in particular. In section 1.3, the focus shifts to the definition of OS, and the defining features of OS are presented in section 1.4. The worldwide use of OS is discussed in section 1.5, while background information on the research problem is presented in section 1.6. The problem statement is explicated in section 1.7 followed by the research objectives and the corresponding questions in sections 1.8 and 1.9 respectively. The scope, assumptions and limitations of the study are discussed in section 1.10 and the organisation of the rest of the dissertation is presented in section 1.11.

1.2 Features of developing countries

This section discusses features of developing countries in general and then shows how these features reflect the potential of ICT in developing countries. The aim of the discussion is to link the challenges related to ICT in developing countries with the strategies that could favour ICT acceptance. According to UNCTAD (2007), a developing country is characterised by the following features:

- *Low income* – based on the gross national income per capita.

- *Low social welfare* – based on indicators of *nutrition* (the percentage of the population that is undernourished), *health* (the child mortality rate), the *school enrolment rate* and the *adult literacy rate*.
- *Economic vulnerability* – based on indicators of *natural shocks* (instability of agricultural production and population displaced by natural disasters), *trade shocks* (instability of exports of goods and services), *economic smallness* and *economic remoteness*.

“ICT or Information and Communications Technology within this context is described as the use of hardware, software, services and supporting infrastructure to capture, process, store, manage and disseminate information” (Prasad 2009). In addition to this definition of ICT, Greenberg (2005) categorises ICT in three ways, depending on how long it has been in use: New ICTs based on digital communications (computers, satellites, mobile phones, the internet, e-mails and multimedia devices), Old ICTs (radio, television, landline telephones and telegraph) and Really Old ICTs (newspapers, books and libraries). The ICTs that are categorised as New ICTs are further facilitated by apparatus known as *software* and *hardware*. *Webster’s dictionary (2011)* defines *software* as “written programs, procedures, rules and instructions that are executed by a computer to accomplish some task”. These software instructions run on a physical device known as *hardware*.

The unfavourable social and economic challenges facing developing countries act as an obstacle to ICT acceptance, because ICT is associated with cost and demand, while the characteristics of developing countries do not provide a positive environment for cost and demand (ECA 2000). Mushi (2007) reveals a number of challenges that face Tanzania as a developing country in Africa. These challenges are also listed in the current Tanzanian government ICT policy (2003:3–6) document created by the Ministry of Communications and Transport. These challenges include the following:

- *Outside donor dependence* in terms of which:
 - there is a low level of local manufacturing in ICT;
 - existing private sectors depend on foreign ICT dealers;
 - research institutions, including ICT research, depend largely on donors from outside the country and the continent at large.

- *Lack of ICT experts.* This is characterised by few ICT institutions and a limited number of ICT trainers with the necessary skills.
- *Language.* The ICT facilities that are available are tailored to English. Since the most popular language in Tanzania is the Swahili language, a significant proportion of the population cannot follow instructions in English.
- *Low income* received by the local people makes it difficult for them to purchase ICT or to use the existing ICT facilities.
- *Poor infrastructure.* Only 14% of Tanzania has electricity (Mushi 2007:19).

Against the broad aim of harnessing ICT to address the social and economic challenges in developing countries, one of the more feasible solutions in alleviating ICT acceptance challenges is the promotion of OS (Chonia 2003; Van Belle and Ellis 2009). Based on the description of OS obtained from the open source organisation website, OS is any ICT software that is open to the public without any interference from the developer of the program/software such that the program/software is transferable and open to modification to suit different demands. OS is therefore an interesting phenomenon within ICT, since its software is freely available and runs on most ICT hardware devices, for example computers, cell phones, satellites and various multimedia devices.

This study investigates OS promotional activities as one of the strategies employed to address ICT acceptance challenges in Tanzania. ICT acceptance challenges in this context are viewed as factors that negatively affect the willingness of a user or user group to employ ICT for the tasks it was designed to support.

After discussing the features of developing countries, the next section gives the definition of OS.

1.3 Defining open source (OS)

The concept *OS* has been discussed and defined by many scholars. According to Fuggeta and Cerri (2007), OS is viewed as an approach to manage the development and distribution of software. OS means that the user of a software program has free access to the source code of the program; moreover, the user can change it and redistribute it (Fuggeta and Cerri 2007). This can be achieved using particular software licences that grant the user these rights.

Stahl (2005) defines OS as software where users have access to the source code. This access distinguishes it from most commercially published software, which only allows users access to the object code (such software is also called *proprietary software*). Free copyright licences for OS software (FOSS) allow everyone to read, modify and redistribute the source code so that programmers can improve and adapt the software and fix bugs. Moreover, the software can be shared with others, so users can give it to their neighbours, colleagues and friends (Bridges 2005). OS is typically developed through public collaboration, it is available to anyone (usually at little or no cost), it does not require proprietary licence fees and it may be freely redistributed (Pogue and Day 2004). Section 1.4 presents the features of OS.

1.4 Features of open source

OS has very specific licensing requirements (Open Source Initiative Movement 2011); these pertain to the distribution, source code and selectivity, which are explained as follows:

- *Distribution.* Software is freely redistributed, while modification and derived work is allowed with no discrimination (universally). There is also free licence distribution.
- *Source code.* The author's source code is made available and its integrity maintained by allowing the changes in the modified source code to be clearly distinguished from the source code of the original author.
- *Selectivity.* No restriction is placed on field selection, the licence is not specific to a particular product, and there is no restriction on other software.

OS can be viewed as software itself, or as an approach to software implementation. As software, the product created is accessible and can be modified, distributed and sold without putting any patent to it. On the other hand, OS can be viewed as an approach to creating free software in a collaborative, visible but controlled environment to ensure a better end product.

For the purpose of this study the definition adopted for OS is *any ICT software created in a collaborative way such that the software is open to the public without any interference from the developer of the program, and the developed program is transferable and open to modification to suit different demands*. Since OS circulation is not essentially controlled, modalities of circulation, including costs, are solely determined by transacting individuals. Table 1.1 illustrates

the characteristics of OS, which form the basis for proposing OS as an option in addressing ICT acceptance challenges in various communities.

Table 1.1: Characteristics of open source

| Characteristics | Description |
|---------------------------------|--|
| Security and quality | There are many developers working on a project and because the source code is provided, inspection is done by many. Owing to these multiple inspections, quality is assured (Ford 2007; O'Reilly 1999). At the same time, because of multiple inspections, an assessment of system exposure and vulnerability is done by hunting for bugs and issuing patches for them (Hoepman and Jacobs 2005) |
| Cooperative development | The Internet and online forums have led to the formation of communities of developers that work together and contribute code to OS projects (O'Reilly 1999; Rota and Osterloh 2007) |
| Improving skills and innovation | Knowledge is transferred and shared among developers and thus increases development skills. Problem-solving tendency of OS brings about innovation (O'Reilly 1999; Schroder, Schrettl and Bitzer 2006; Johnson 2006; Kogut and Metiu 2001). |
| Cost-effective | The software is free of charge for download and, because it has large groups of developers working on it, it may reduce transaction costs (Johnson 2006; Chonia 2003; Bruggink 2003). |

It may be argued that the features of OS outlined in Table 1.1 support and enhance ICT acceptance better than those of its counterpart proprietary software. Section 1.5 gives a brief account of the use of OS in the world.

1.5 Worldwide use of open source (OS)

The use of OS in developing countries is inspired by the OS successes in developed countries. OS has been used in different parts of the world (Weber 2004; McKendrik 2007). For example, Weber (2004) states that nearly 40% of large American companies and 65% of Japanese corporations use Linux in some form. He also claims that an EU survey found out that 43.7% of German companies and 31.5% of British companies use OS. Furthermore, a giant software company such as Oracle uses 60% of OS web servers, for example Apache (McKendrik 2007:5).

Similarly, a special report by the United States (US) Government Technology magazine released in 2006 shows that 50% of the top websites in the US run on OS servers, and that of the 50 states in the US, 47 are already running OS-based systems and 50% of government agencies also use OS in some form.

The successes of OS in developed countries could inspire similar OS successes in developing countries. However, this will require an understanding of the factors that influence OS use in developed countries. To understand the conditions in developing countries, studies have to be undertaken to establish ICT acceptance challenges and the way in which OS could serve as one of the strategies to address ICT acceptance challenges (Shi, Hutchinson, Yuc and Xua 2001). However, OS could contribute to ICT acceptance if promotional efforts can be strategically planned and implemented effectively (Walsham and Sahay 2006). For example, if the features of developing countries are mapped onto the characteristics of OS, it may be possible to design OS promotional activities to suit the ICT challenges identified. In the next section we discuss the background to the problem examined in this study.

1.6 Background to the problem

This section gives some background on the research problem in order to explain why this study was worth undertaking. The background information focuses on the state of ICT acceptance in developing countries in general, and Tanzania in particular, as well as the prospects for addressing ICT acceptance challenges through OS promotional strategies.

ICT is important in the key sectors of society, including education, health, social policy, commerce and trade, government administration, agriculture and communication (Chonai, 2003; Camara and Fonseca 2007). However, ICT in developing countries, and in Tanzania in particular, faces acceptance challenges in efforts to bring about the desired development. In order to address these challenges in developing countries, various strategies have been employed, including e-governance, World Bank intervention programmes and the establishment of OS communities. However, various evaluations indicate that such efforts have not addressed the ICT challenges as expected. For instance, more than half of the strategies adopted in developing countries to foster ICT did not help to overcome the acceptance challenges experienced (Camara and Fonseca 2007). Furthermore, as regards e-governance, 35% of initiatives made no impact on

ICT acceptance, 50% made little impact and only 15% showed significantly positive impacts (Heeks 2002a).

With reference to Africa, Nauman, Aziz and Ishaq (2005) found that the majority of World Bank supported ICT programmes in Africa are partial failures. The authors do not, however, indicate the factors behind this failure, which suggests that programme review is necessary for improving the ICT-related programmes adopted in developing countries in general and Tanzania specifically.

Recommendations have been made as to what could be done to alleviate ICT acceptance challenges. One such recommendation is to ensure that programmes aimed at alleviating ICT acceptance challenges are sustainable (Camara and Fonseca 2007). In particular, the main objective of any technology is ensuring sustainable task completion (Godfrey 2006). Sustainability in this context is defined as the challenge to make the technology work in practice over time and in a local setting (Braa, Monteiro, and Sahay 2004). The importance of the local setting is stressed by Thorbergsson, Björgvinsson and Valfell (2007), as they argue that a well-established information system is one that can change with the environment and the requirements, and where imported technology is tailored to the requirements of a particular local setting. Godfrey (2006) argues that ICT is likely to be accepted when it is suited to user needs. Statistics on ICT acceptance research shows that 29% of implemented ICT programmes do not have a clear goal, while 27% are not relevant to user needs (Godfrey 2006).

As a developing country, Tanzania faces a number of ICT acceptance challenges. For example, many areas that have the potential to use ICT either do not use it or else there is minimum use. In particular, very little use of ICT is made in the education, health, commerce and administration sectors. Merriam Webster, an American dictionary, defines usage as “a firmly established and generally accepted practice or procedure”. ICT acceptance can, therefore, be viewed as the established and generally accepted practices of ICT in enhancing economic development.

Among the efforts to address ICT acceptance challenges in Tanzania is the use of OS. However, in order to ensure the use of OS, it has to be promoted. Accordingly, some OS communities have been formed to promote the use of OS in Tanzania. These promotional activities aim at making the public aware of the existence of OS and encouraging its use. However, the degree of success in OS promotion depends on the extent to which OS promotion takes into account the needs of

actual and potential OS users. OS promotional activities should specifically consider such factors as local environment, sustainability, cost-effectiveness and others that make OS worth using. To this end, the current study assesses OS promotional efforts in which OS is used as a strategy to address ICT acceptance challenges in Tanzania. The research problem is stated in the following section.

1.7 Statement of the problem

ICT acceptance faces challenges in developing countries (Camara and Fonseca 2007; Chonia, 2003). These acceptance challenges have resulted in low ICT usage and lack of acceptance. Consequently, given the economic and social importance of ICT, there is a need to address ICT acceptance challenges in developing countries. There are many strategies for addressing ICT acceptance challenges, one of which is the adoption of OS. However, in order to make OS an acceptable strategy for addressing ICT acceptance challenges, there is a need to promote OS in a way that really addresses these challenges.

In Tanzania, in particular, it is evident that ICT acceptance challenges exist in different areas of possible usage (URT 2003). One of the strategies that has been adopted to address these challenges in that country is OS and initiatives to promote OS have been undertaken (Mushi 2007). The purpose of this study is to assess OS promotional efforts as a strategy to address ICT acceptance challenges in Tanzania. This is done by examining the nature and impact of OS promotional activities in relation to ICT acceptance challenges.

1.8 Research objectives

1.8.1 General objective

The general objective of this research is to assess the promotion of OS as a strategy for addressing ICT acceptance challenges in Tanzania.

1.8.2 Specific objectives

The research specifically endeavours to achieve the following objectives:

1. determine ICT acceptance challenges in Tanzania;

2. examine OS promotional activities in Tanzania;
3. evaluate OS promotional activities in the light of ICT acceptance challenges in Tanzania.

1.9 Research questions

This research endeavours to provide answers to three questions corresponding to the three objectives outlined in section 1.8.2 above:

1. What are the ICT acceptance challenges in Tanzania?

The question of *ICT acceptance challenges in Tanzania* was explored both by conducting a literature content analysis and by obtaining information from a survey and face-to-face interviews. The literature analysis investigated the factors that hinder ICT acceptance in different parts of the world and the way they manifest in Tanzania, while further information was obtained from primary data gleaned from the survey and the interviews. The factors that hinder ICT acceptance include system characteristics, user and task characteristics, the nature of the development or implementation process, political and economic influences, the language, and the organisational culture (Davis 1986; Mushi, 2007; Van Belle and Ellis 2009).

2. What is done to promote open source in Tanzania?

Information on the nature of activities deployed to promote OS was first extracted from an analysis of the documents that emanate from OS communities, which show their plans and activities. Further details were obtained from the survey and the interviews conducted with respondents. In addition, the researcher participated in online discussion forums where he was able to find out what was actually taking place in respect of OS promotion.

3. How successful is open source promotion in addressing the ICT acceptance challenges in Tanzania?

Data on the success of OS promotion in relation to ICT acceptance challenges was drawn particularly from end-user informants using a survey and interviews. In particular, reasons for the use or non-use of OS in different areas were determined in order to

ascertain what had been achieved as a result of the efforts made through OS promotion.

In the section that follows we explain the scope, assumptions and limitations of the study.

In providing answers to raised research questions, an interpretive mixed method research approach was employed for this study. This mixed method research is a combination of interpretive, qualitative and quantitative approaches for data analysis. A case study methodology was used in studying the OS promotions activities amongst various communities in Tanzania. The case study was conducted using methods of triangulation on the data level. Data was collected through a survey, interviews, observation and the use of documents

1.10 Scope, assumptions and limitations

1.10.1 Assumptions

For the purpose of this study, ICT challenges are assumed to be a high-level concept that includes technical, social, political, cultural and economic aspects. The examination of ICT challenges from the perspective of technology acceptance will identify specific ICT acceptance challenges more specifically as, for example, resources, context, knowledge, language and policy. This study dealt only with *ICT* acceptance challenges.

The technology acceptance literature, as discussed in Chapter 2, deals with the concepts of *use* and *acceptance*. Although acknowledging that *use* and *acceptance* may have different implications in the literature, for the purpose of this study, *use* is assumed to be the ultimate goal of *acceptance* and the terms *acceptance* and *use* may be used interchangeably.

In the Information Systems literature, the terms *acceptance* and *adoption* are sometimes used interchangeably in the context of technology adoption. In this study, however, the term *acceptance* will be aligned with the technology acceptance models in information systems.

1.10.2 Scope

The scope of this study is limited to assessing OS promotional efforts in Tanzania as a strategy to address ICT acceptance challenges. There may be many strategies for addressing ICT acceptance challenges, but the present study is limited to OS promotion only. The term *promotion* as used in

the present investigation to refer to *the attempt to make practitioners and the general public aware of the existence of OS and the merits associated with its use.*

1.10.3 Limitations

As ICT acceptance challenges penetrate different sectors, it would be expected that a good number of stakeholders would be included in the present study. For instance, OS developers, OS communities, users and policy makers were all potential respondents. Owing to time, resource and logistic constraints, however, the study involved four OS communities in Tanzania only. As far as OS users were concerned, only online OS community subscribers could be reached because of their online availability and their possibility in completing a questionnaire distributed online. Indeed, if offline stakeholders could have been included, the results might have been different. In addition, no political figure or policy maker was involved even though Tanzania has a commission responsible for ICT-related matters. This is a gap that future investigations could consider.

The organisation of the study is presented in section 1.11.

1.11 Organisation of the study

In this, the introductory chapter, the research project was introduced with a discussion on the background, research problem, questions and scope. Chapter 2 is devoted to a review of the literature on technology acceptance and OS, while Chapter 3 discusses the research approach, and the methods and procedures employed in generating data for this study.

Chapter 4 presents an analysis of the literature on ICT acceptance challenges by illustrating a model that presents all the acceptance models described in Chapter 3. A technology acceptance model for OS is also presented. The data capturing context is presented in Chapter 5 while the data analysis and a discussion of the findings are presented in Chapter 6.

Chapter 7 presents the final conclusion and recommendations and contextualises them to show the contribution this study makes to the existing body of knowledge. In Figure 1.1, the chapter map for this dissertation is presented.

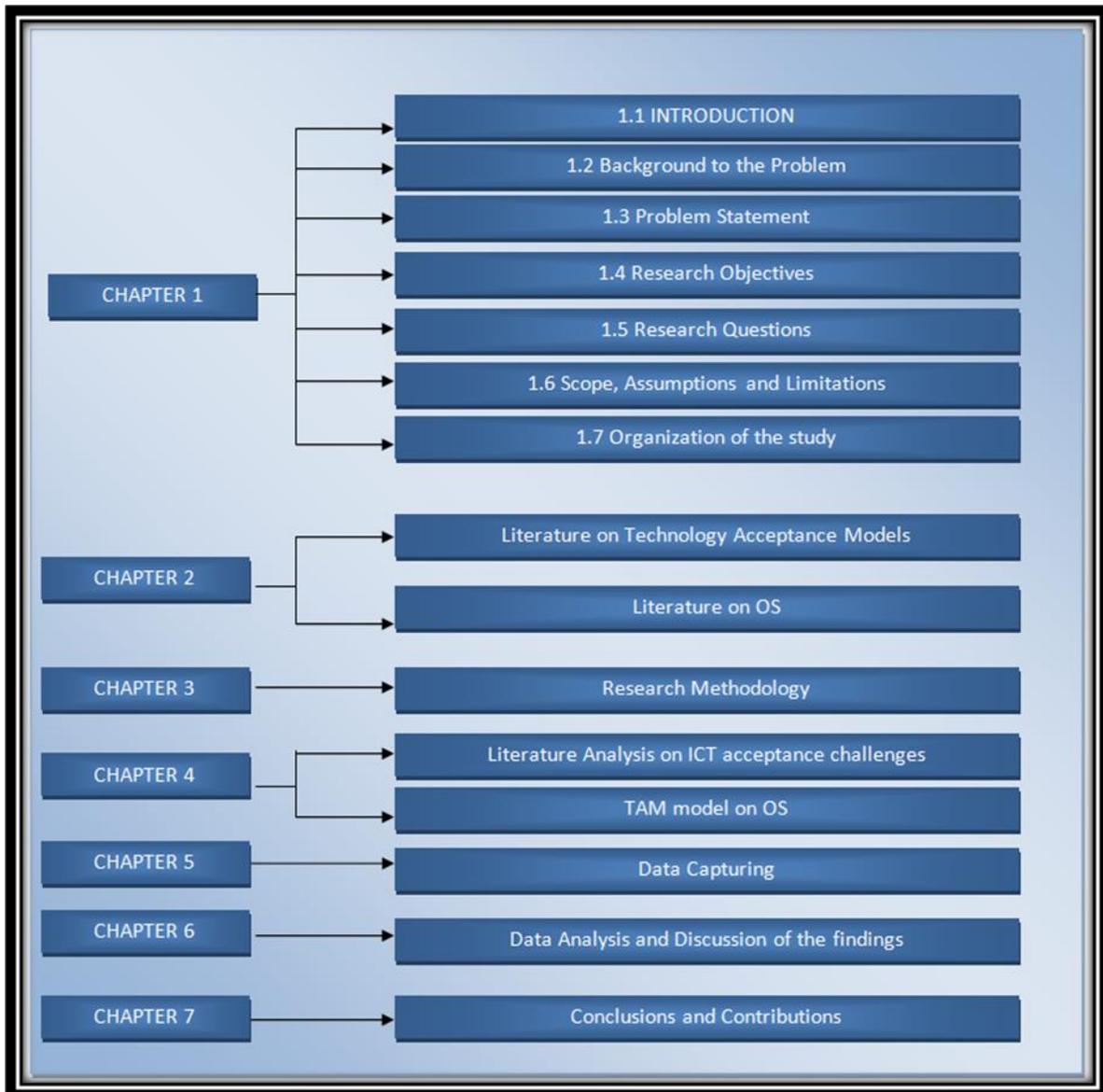


Figure 1.1: Chapter map for the research

CHAPTER TWO: LITERATURE REVIEW

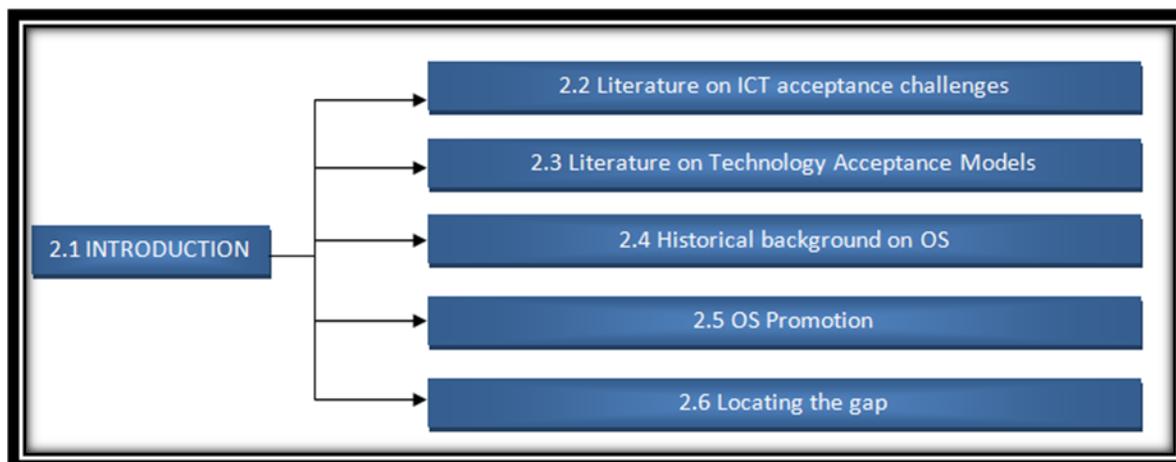


Figure 2.1: Discussion flow for Chapter 2

2.1 Introduction

This chapter presents a review of the literature related to the investigation of OS promotional efforts in Tanzania in terms of ICT acceptance challenges. The aim is to provide a theoretical background on ICT acceptance challenges and the role OS promotion plays in addressing such challenges. Accordingly, the review considers ICT acceptance challenges in relation to OS promotion in different parts of the world and Africa, before focusing particular attention on Tanzania as the case country. The flow of the discussion is depicted in Figure 2.1.

2.2 ICT acceptance challenges

ICT challenges in the present context refer to factors that negatively affect the design, development and implementation of ICT, as well as the social, political, cultural and economic factors that hinder firmly established and accepted practices or procedures of ICT usage. ICT acceptance challenges are factors that negatively affect the willingness of a user or user group to employ ICT for the tasks it was designed to support.

ICT challenges as a concept are broader than *ICT acceptance challenges*, and in this study ICT acceptance challenges are regarded as a subset of ICT challenges. An understanding of ICT acceptance challenges could influence the nature of OS promotion and also guide the appraisal of OS promotional activities.

The ICT acceptance challenges experienced in urban and rural areas differ, in that rural areas have more ICT acceptance challenges than urban areas (Samah et al. 2011). Samah et al. (2011) employed various models to explore the level of ICT acceptance challenges in rural areas in Malaysia and found that ICT acceptance challenges led to the failure of most ICT programmes. One example of such a challenge is that too much emphasis is placed on the technical aspects of the product instead of focusing on the most important part, that is, *user acceptance* (Verdegem and Marez 2011). User acceptance in this case refers to the demonstrable willingness within a user group to employ ICT for the tasks it is designed to support (Lee, Cho, Gay, Davidson and Ingraffea 2003).

ICT acceptance challenges in Africa have been identified by various authors (Danowitz, Nassef and Goodman 1995; Hussain and Oshikoya 1998; Keats, Beebe and Kullenberg 2003; Keats and Beebe 2004). For instance, Danowitz et al. (1995) conducted research in a number of North African countries to identify the ICT acceptance challenges they face in introducing ICT. The findings showed that poor telecommunications infrastructure was the major challenge. For example, in 1995, the whole of North Africa contributed only 0.76% of all telephone lines worldwide. Accounting for the poor infrastructure, Hussain and Oshikoya (1998) argue that the limited supply of telecommunication infrastructure in Africa is caused by government dominance and monopoly in the sector. Private companies were not given the opportunity to participate by investing in the telecommunication sector thus reducing the effectiveness and speedy establishment of telecommunications infrastructure.

The findings in North Africa replicate findings in other parts of Africa where economic liberalisation is lacking or is in its infancy (Keats et al. 2003; Keats and Beebe 2004; Massingue 2003). The authors also identify other ICT acceptance challenges, including the brain drain and language barriers, in terms of which people who have acquired ICT knowledge prefer to work outside their countries where their skills are more marketable and the work more rewarding. The transfer of skills is, therefore, done to the wrong people because they do not ensure that the skills are disseminated to the wider public. As for language, most ICT programs that are created cater for those who can speak English, thus marginalising local populations. As a result, a person first has to understand English before he or she can think of becoming literate in or using ICT (Chonia 2003).

Other issues like political instability, civil wars, cultural influences and government policies have also led to ICT acceptance challenges across the African continent (Lee and Cole 2003). This makes the diffusion of ICT in some societies extremely difficult. For example, in some cultures, traditional ways of education do not require the use of ICT and this, in the long run, leads to information illiteracy, which, in turn, results in more ICT acceptance challenges.

Mushi (2007) lists the ICT acceptance challenges that face Tanzania as a developing economy in Africa. The same challenges are also listed in the current Tanzania ICT policy (2003:3–6) document created by the Ministry of Communications and Transport. These challenges include the following:

- *Outside donor dependence* resulting in a low level of ICT use by local business, lack of organisations in the private sector that import the technology from outside, and research institutions that largely depend on outside donors.
- *Lack of ICT experts*. This is characterised by a small number of ICT institutions and a limited number of ICT trainers with the required skills.
- *Language barriers*. The available ICT facilities are tailored for English. Since the most popular language in Tanzania is Swahili, Tanzania is at a disadvantage in terms of the language used for ICT communication.
- *Low income*. The low wages earned by the local people make it difficult to purchase and use existing technology.
- *Poor infrastructure*. In 2007, a country of nearly 42 million people (World Bank 2011), only 14% of the country has electricity (Mushi 2007:19). Furthermore, the percentage of Internet users in 2007 was 0.96%, which is very small. However, the trend line shown in Figure 2.2 indicates that the number of Internet users is increasing over time.

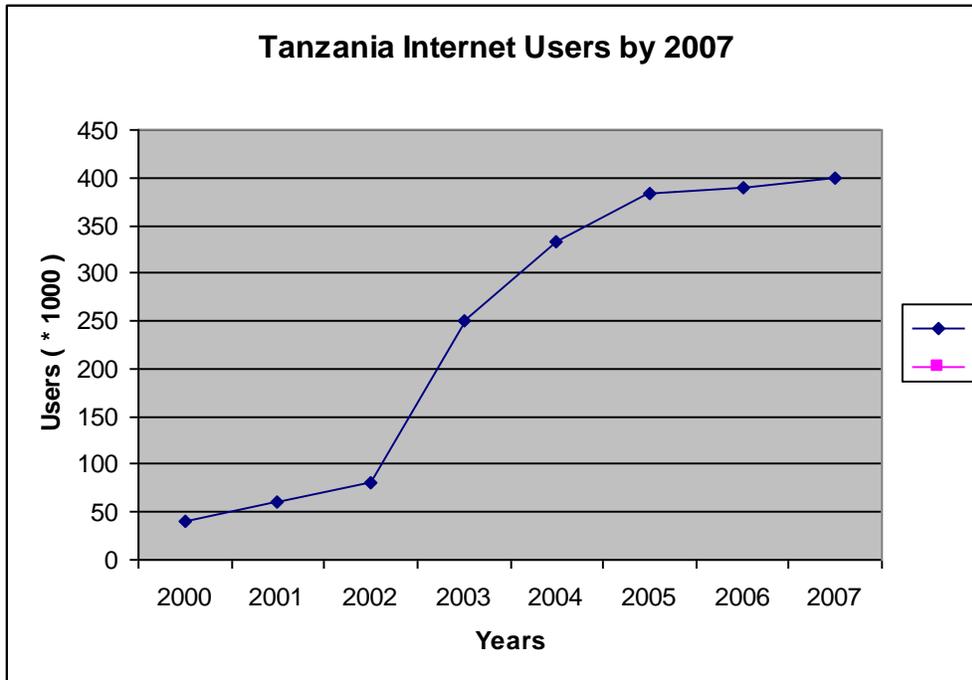


Figure 2.2: Internet usage in Tanzania from 2000 to 2007 (Mushi 2007)

The ICT acceptance challenges mentioned above are common in Africa as the continent enters the information age (UNCTAD 2007). Consequently, a great deal of research has been done that proposes solutions to these challenges. Hussain and Oshikoya (1998), Godfrey (2006), Paris (2002), Heeks (2002a; 2009) and Nauman et al. (2005) note that the continent has made some progress in the establishment of ICT products; however, more has to be done in order for ICT acceptance challenges to be addressed. One of the ways to address the challenges is to study the factors that may increase its acceptance. This study assesses the promotion of OS as one of the potential ways of addressing ICT acceptance challenges in the context of Tanzania. In the next section we discuss the various technology acceptance models in order to gain insight into the factors that influence ICT acceptance.

2.3 Technology acceptance models

An understanding of different acceptance models is relevant to this study, since such models explain in theory how a user comes to accept and use new technology. The decision to accept and use various technology is influenced by *determinants*; that is, parameters that influence technology acceptance (Verdegem and Marez 2008, 2011). As this study particularly seeks to

uncover the role that OS promotion plays in ICT acceptance challenges, it is worth understanding the factors that allow users to accept ICT. In this study, *acceptance* is defined as “the demonstrable willingness within a user group to employ ICT software for the tasks it was designed to support” (Lee and Cole 2003).

In research on ICT acceptance, various models have been developed that focus on technology acceptance (Schaper and Pervan 2004). These models are independent of the specific technology; hence, they are generic, abstract, high-level, conceptual constructs that show processes, variables and relationships without describing the methods of implementation.

Zhang (2007) believes that ICT adds value if it is accepted and continuously used by the intended users, and points out that this is a major reason for the growing interest in ICT user acceptance. However, technology acceptance models differ in terms of user acceptance determinants and perceptions (Sandberg and Wahberg 2006; Sun and Zhang 2005). In the sections that follow, some of the most influential technology acceptance models will be discussed, beginning with Technology Acceptance Model (TAM).

2.3.1 Technology Acceptance Model (TAM)

One of the models that discuss factors for technology acceptance is the TAM, which was developed by Davis (1986; 1989) and which comprises the following:

- *External variables (EV)*. These include system characteristics, user characteristics, task characteristics, nature of the development or implementation process, political influences and organisational culture.
- *Perceived usefulness (PU)*. This is the user’s subjective belief in the probability that using a specific application system will increase his or her job performance within an organisational context.
- *Perceived ease of use (PEOU)*. This is the degree to which the user expects the target system to be free of effort.
- *Attitude towards using (A)*. This refers to the user’s desirability towards using the system.
- *Behavioural intention to use (I)*. This consists of the user’s attitude and the perceived usefulness which influence the individual’s behavioural intention to use the system.

- *Actual system use (U)*. This refers to individual use of the system.

Figure 2.3 provides a graphical representation of the variables in TAM.

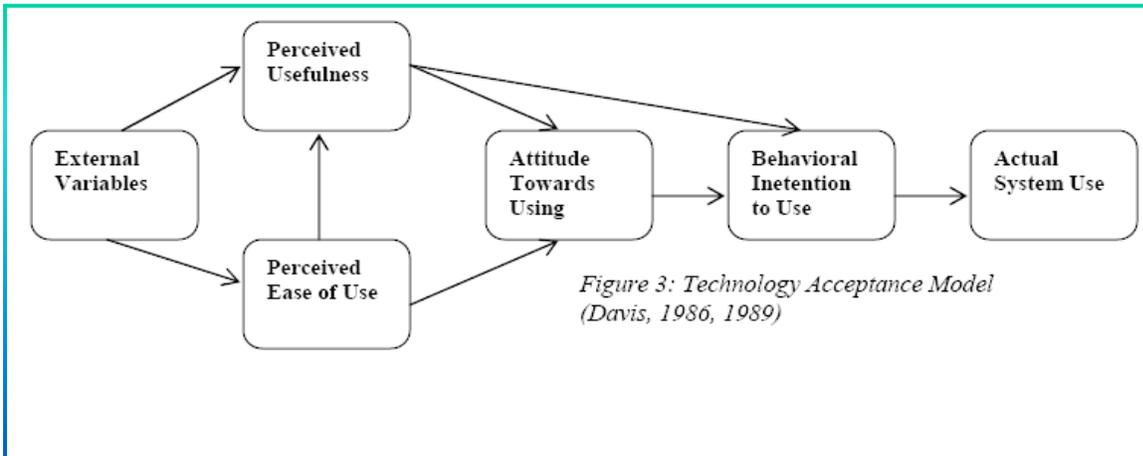


Figure 2.3: Technology acceptance model (Davis 1986; 1989)

TAM is relevant to this study since it takes into consideration the properties of the user and those of the technology to be used. In other words, TAM suggests that technology has to be evaluated in terms of its characteristic features in relation to the potential user. Accordingly, we need to consider OS promotion in relation to the needs of the users. In developing countries such as Tanzania, users differ in terms of what they need OS for, and in their ability to use it. Thus, OS promotion should include relevant features that capture the sociocultural differences across communities and thus add to the suitability of the TAM. The section that follows presents TAM 2.

2.3.2 TAM 2

TAM 2 relates to the way the user perceives the usefulness of technology, that is, *perceived usefulness*. Perceived usefulness, as a determinant of TAM, was identified by Venkatesh and Davis (2000) as having six general determinants, which include *subjective norm, image, job relevance, output quality, result demonstrability* and *perceived ease of use*.

TAM2 categorises the determinants of perceived usefulness into two theoretical constructs, namely, *social influence* and *cognitive instrumental processes* (Venkatesh and Bala 2008). *Social influence* can be described as the degree to which an individual perceives that it is important that others believe that they should use the system (Venkatesh, Morris, Davis and

Davis 2003), while *cognitive instrumental processes* are based on the idea that the perceived usefulness of a system is determined cognitively by comparing what the system can do and what is needed to be done to complete the task (Venkatesh and Davis 2000). The determinants influencing social influence processes are the first two determinants of perceived usefulness (*subjective norm and image*), while determinants that influence cognitive instrumental processes are the remaining perceived usefulness determinants – *job relevance, output quality, and result demonstrability*. Table 2.1 summarises the determinants of perceived usefulness identified in TAM2.

Table 2.1: Determinants of perceived usefulness identified in TAM2

| Determinants | Definition | Theoretical processes |
|-----------------------|---|---|
| Perceived ease of use | The degree to which an individual believes that using a system will be free of effort (Davis 1989) | System characteristics/cognitive instrumental process |
| Subjective norm | The degree to which an individual perceives that most of the people who are important to him think he should or should not use the system (Venkatesh and Davis 2000; Fishbein & Ajzen 1975) | Social influence process |
| Image | The degree to which an individual perceives that using a system will enhance his/her status within the social group (Chismar and Patton 2002) | Social influence process |
| Job relevance | The degree to which an individual perceives that the system is applicable to his/her tasks (Venkatesh and Davis 2000) | Cognitive instrumental process |
| Output quality | The degree to which an individual believes that the system used has performed the | Cognitive instrumental |

| | | |
|------------------------|---|--------------------------------|
| | tasks well (Venkatesh and Davis 2000) | process |
| Result demonstrability | The degree to which an individual perceives that the results of system use are tangible, communicable and observable (Moore and Benbasat 1991; Venkatesh and Bala 2008) | Cognitive instrumental process |

TAM2 is relevant to this study as it perceives the potential user of technology as belonging to a social group which can influence his or her behaviour, including adopting or not adopting a certain kind of technology. Based on this influence, it is also possible for the user to influence other users around them. TAM2 also considers the cognitive ability of the user to use technology, which conditions technology designers to modify technology according to the cognitive level of the users. By accommodating both the social and the cognitive determinants of the user, TAM2 provides users with relevant choices of technology based on its social and cognitive aspects. The model could therefore be used as a guide to OS promotional activities and evaluation. TAM3 is explained in the next section.

2.3.3 TAM 3

TAM3 is an attempt to create a relationship between *perceived ease of use* and *perceived usefulness*, *computer anxiety* and *perceived ease of use*, and *perceived ease of use* and *behaviour intention*. In terms of this model, Venkatesh (2000) shows that perceived ease of use is characterised by six other determinants, namely computer self-efficacy, perception of external control, computer anxiety, computer playfulness, perceived enjoyment and objective usability. According to TAM3, the determinants of *perceived usefulness* do not influence *perceived ease of use* and *perceived ease of use* does not influence *perceived usefulness*. The determinants of perceived ease of use and their descriptions are listed in Table 2.2.

Table 2.2 Determinants of perceived ease of use

| Determinant | Definition |
|--------------------------------|--|
| Computer self-efficacy | This is the degree to which an individual believes he/she has the ability to use computers to complete a certain task (Compeau and Higgins 1995a; 1995b). |
| Perception of external control | This is the degree to which an individual believes there is community or organisational support that would provide the technical resources for using a system (Venkatesh et al. 2003). |
| Computer anxiety | This is the degree of discomfort or fear elicited by the idea of using a computer (Venkatesh 2000). |
| Computer playfulness | This is the degree of human–computer interaction that comes spontaneously upon using a new system (Venkatesh and Bala 2008). |
| Perceived enjoyment | This is the degree to which system usage is perceived to be enjoyable. |
| Objective usability | This is the degree to which a system is compared not on perception but based on the actual level of efforts needed to complete a given task (Venkatesh 2000). |

TAM3 is relevant to this study in that, as experience increases with system use, users become more comfortable, thus having a positive influence on *perceived ease of use*. This will result in their becoming innovative in the use of the system, which will, in turn, influence perceived usefulness. Increasing hands-on experience with a system creates new system-specific beliefs that differ from general computer beliefs. These beliefs will lessen computer anxiety, which negatively affects perceived ease of use. Hands-on experience among users creates new knowledge among them and this might result in them worrying less about perceived ease of use and caring more about their

intentions to use the system. Extensions to TAM are presented and explained in the following section.

2.3.4 TAM extensions

Lee and Cole (2003) extended the TAM model by adding two additional factors:

- *Expectation.* Expectation explains the belief about an individual's performance gains from using the technology, while social expectation is the expectation of social and entertainment experiences from using the technology.
- *Satisfaction.* Most TAM studies fail to address the issue of user satisfaction as an outcome of the model. Consequently, satisfaction is manifested by the acceptance model and not really tested after the technology has been put in place (Lee and Cole 2003).

Figure 2.4 shows the interrelationship of variables in the extended TAM model.

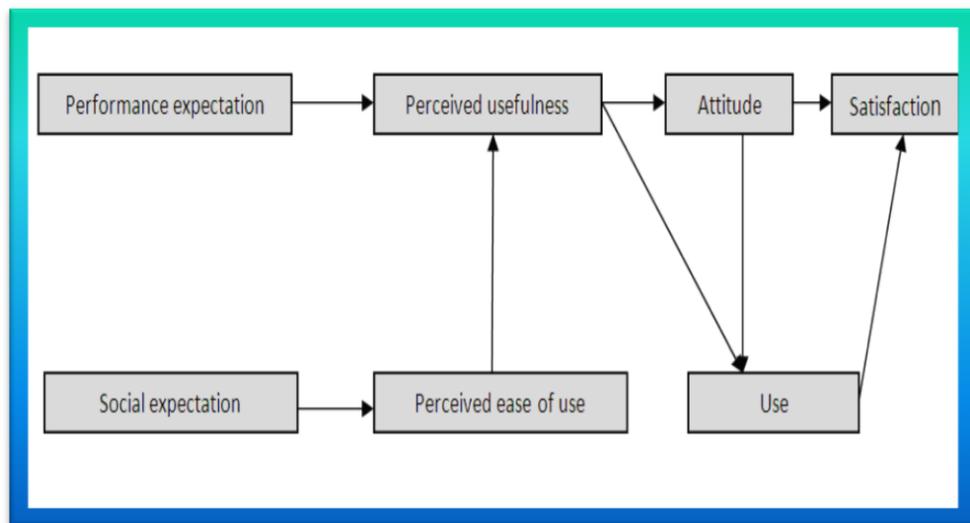


Figure 2.4: TAM as extended by Lee and Cole (2003)

Upon studying the application of TAM in rural settings in Malaysia, Samah et al. (2011) concluded that a *positive attitude* towards ICT instils in people a belief that ICT will assist and enhance their performance. Regarding ICT wider access and fast

processing, *perceived ease of use* and *perceived usefulness* has facilitated to sustainable ICT usage amongst the community in rural settings in Malaysia.

Although the ICT acceptance variables pertain to the situation in Malaysia, they are relevant to the present study in that they provide insight into the factors that could predict ICT acceptance among users in other parts of the world in general, and Tanzania specifically. The following section presents the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

2.3.5 Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT model was formulated in 2003 by Venkatesh et al. (2003) in an attempt to provide a unified view of acceptance. UTAUT as a model encompasses the theoretical similarities of the eight acceptance models, namely the Theory of Reasoned Action (TRA), the TAM, the Motivational Model (MM), the Theory of Planned Behavior (TPB), the combined TAM and TPB, the Model of PC Utilisation (MPTU), the Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT) (Gupta, Dasgupta and Gupta 2008; Schaper and Pervan 2004).

The advantage of the UTAUT model is that it is able to explain 70% of user acceptance behaviour, which is a great improvement on the 40% success rate obtained by the other models (Venkatesh et al. 2003). UTAUT is based on the following four user acceptance determinants (Tibenderana and Ogao 2008; Venkatesh et al. 2003).

- *Performance expectancy*. The degree to which a user believes that using a technology will provide gains in their job, study, teaching or research performance.
- *Effort expectancy*. The degree of ease in using the system.
- *Social influence*. The degree to which an individual perceives that it is important that others believe that they should use the new system.
- *Facilitating conditions*. The degree to which individuals believe that there is organisational and technical support for using the system.

Figure 2.5 shows the interrelatedness of the determinants of UTAUT.

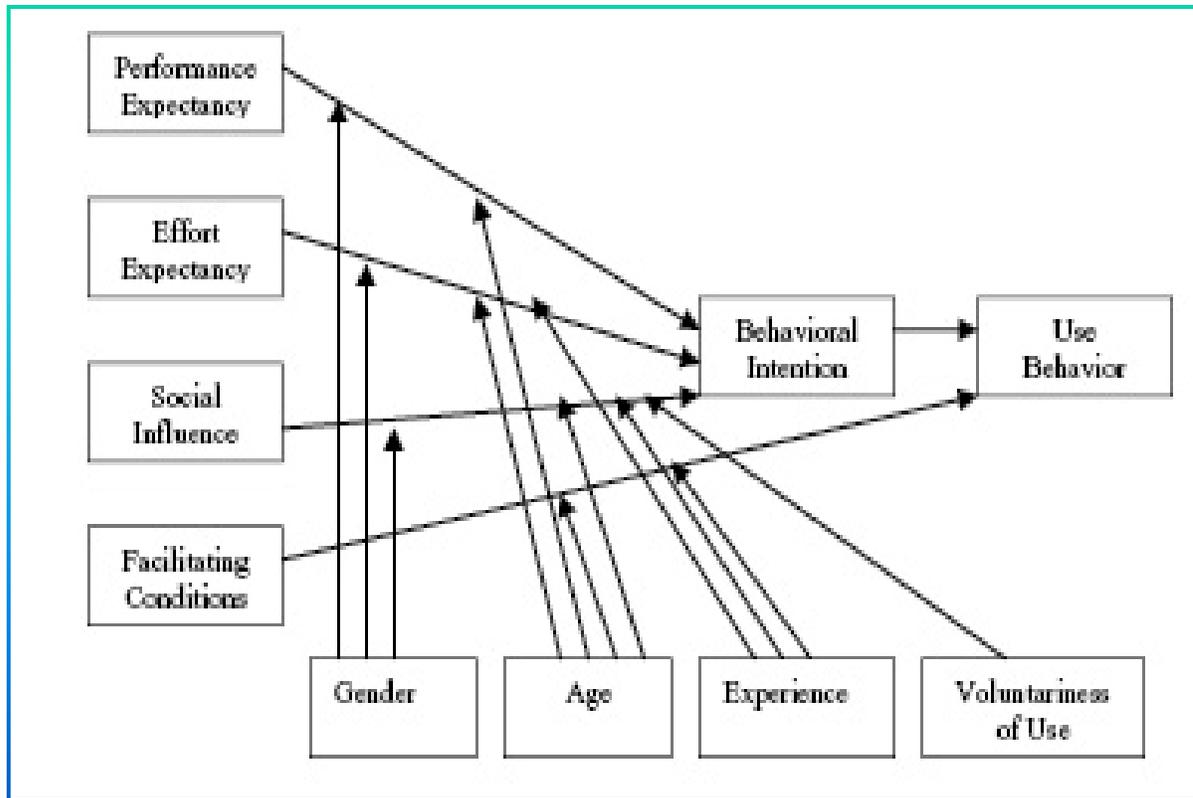


Figure 2.5: Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003)

The UTAUT is relevant to this study in a number of ways. Firstly, upon formulating the UTAUT, Venkatesh et al. (2003) proposed that its determinants are moderated by gender, experience, age and voluntariness. These moderators are regarded as characteristics that influence the determinants of ICT acceptance (Verdegem and Verhoest 2008). This means that UTAUT assimilates some of determinants that have not featured directly in TAM and its versions and extensions, such as gender and age. These demographic determinants are relevant to technology acceptance and adoption, as they also determine other social roles and relationships.

Secondly, UTAUT is reported to have shown successes in some areas. For example, in studying the user acceptance behaviour of UTAUT in the health sector, Schaper and Pervan (2004) concluded that *performance expectancy* and *facilitating conditions* had a positive influence on the behavioural intentions in the usage of ICT in the health sector. However, *effort expectancy* and *social influence* were seen as insignificant. The same results were

obtained by Tibenderana and Ogao (2008), who showed the irrelevance of *social influence* and *effort expectancy* upon validating the user acceptance behaviour of hybrid library service end-users in Uganda. On the other hand, in a study conducted in Nigeria, Anandarajan, Igbaria and Anakwe (2002) found that the effect of social pressure as an ICT acceptance determinant is an important factor in the usage of computers. This shows that the UTAUT determinants are not necessarily valid in all cases of ICT usage, but depend on the uniqueness of the ICT sector and the environment. The ASA approach to technology acceptance is presented in section 2.3.6. As discussed in this section, the ASA approach was proposed in an attempt to relate access to skills and attitudes.

2.3.6 ASA approach to technology acceptance

Verdegem and Verhoest (2008) propose another theory which uses the ASA approach to explain matters that address technology acceptance in a society. The authors view ASA approach as a specific combination of conditions in terms of *access* to ICT, *skills* to master the devices and *attitudes* towards the technology. In other words, as shown in Figure 2.6, technology acceptance, according to the ASA approach, is based on factors of ICT access, ICT skills and user attitudes towards ICT.

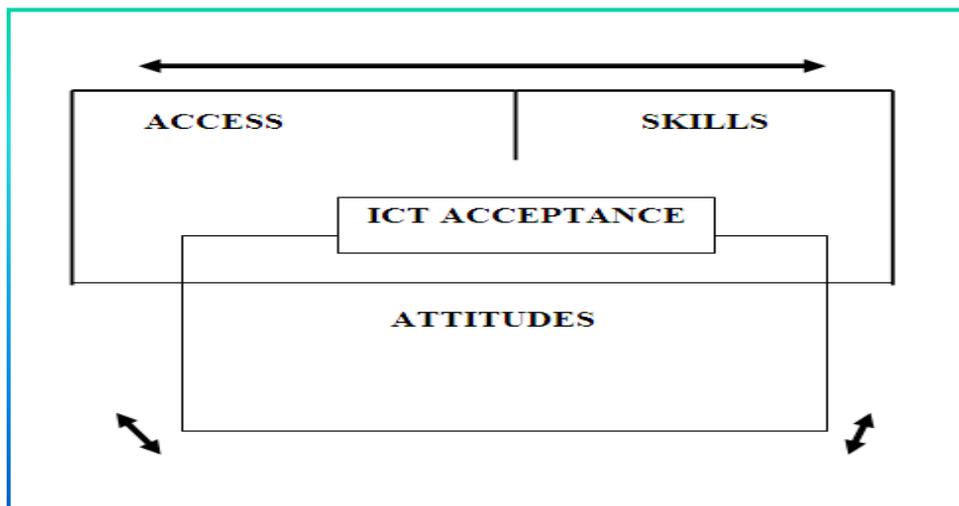


Figure 2.6: The ASA approach (Verdegem and Verhoest 2008)

The ASA approach is relevant to this study since it insists that technology designers and practitioners should consider the issue of affordability on behalf of their clients. This aspect is applicable to this study, as one of the features of developing countries is low income.

Moreover, the issue of cost has featured consistently in the literature as one of the challenges facing ICT acceptance. Since one of the features of OS is its cost-effectiveness, we can predict that more people should be able to afford it. Similarly, as provided for by the ASA, the skills needed to use certain devices have to be considered, because one could avoid using certain technology in order to avoid the embarrassment of not having the necessary skills. As for OS promotional efforts, potential users should be given an opportunity as part of the promotion to learn the skills required.

The final technology acceptance model considered in this study is the Task–Technology Fit (TTF), which is explained in the following section.

2.3.7 Task–Technology Fit (TTF)

Among the observed weaknesses of the technology acceptance models such as TAM is their inability to address the actual tasks that are to be carried out by the ICT tools that are in place. Accordingly, their focus on user intentions has led to mixed results in ICT evaluation (Dishaw and Strong 1998). A concentration on both user tasks and ICT tool functionalities is said to be an important step in understating ICT usage and acceptance (Benslimane, Plaisent and Bernard 2003). The TTF was therefore created to relate technology to the particular tasks performed by a user (Goodhue and Thompson 1995). The TTF is graphically presented as Figure 2.7.

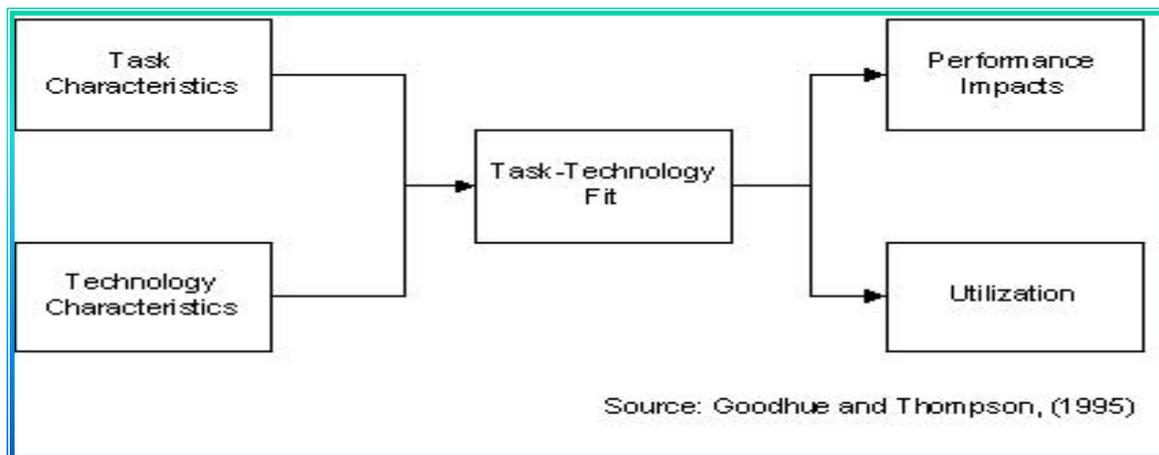


Figure 2.7: The TTF model (Goodhue and Thompson 1995)

Goodhue and Thompson (1995) explain the determinants of the TTF model as follows:

- *Task characteristics.* These are activities carried out by individuals in turning inputs into outputs.
- *Technology characteristics.* These are the tools used by individuals in carrying out their tasks.
- *Performance impacts.* This relates to the accomplishment of a portfolio of tasks by an individual.

According to the model, the user tasks are defined as activities that are carried out in turning inputs to outputs, in this case with the assistance of an ICT tool (Klopping and McKinney 2004).

The TTF is particularly relevant to this study since the nature of the task and the technological tool has to be considered so that users can see the benefits of the technology. Indeed, OS has been found to be modifiable to fit different types of task. The other features of the TTF have also featured in other models as they relate to the features of the technology. The TTF model (Goodhue and Thompson 1995) has been used in conjunction with other technology acceptance models to explain the actual usage of systems by users (Gebauer, Shaw and Gribbins 2006).

Since the study looks at OS promotional efforts to address ICT acceptance challenges, the section that follows provides a review of the literature relevant to OS. In particular, section 2.4 discusses the historical background of OS.

2. 4 Historical background of open source

This section gives a brief history of the evolution of OS, as well as its penetration into different areas of application. This information is relevant to the present study as it shows the stages through which OS has progressed, the challenges it has faced and its subsequent acceptance in developed countries, which in turn informs practices in developing countries and, indeed, Tanzania, as they use OS strategies to address ICT acceptance challenges.

Although OS gained popularity in the 1990s, its origins can be traced back to the 1980s to the free software foundation movement initiated by Richard Stallman (Evans and Reddy 2002). Early in the 1980s, a great deal of code was written by developers for academic purposes,

including software code that would help mainframe computers achieve their designated tasks. Large commercial companies recognised the opportunity to use these academic software programs as sellable products from which they could obtain profits (Katz 2008). Having worked as a researcher for the MIT Artificial Intelligence laboratory in 1983, Richard Stallman saw that it was unfair for large commercial organisations to use freely released code for their own benefit. He therefore initiated a movement called the Free Software Foundation whose purpose it is to ensure that developed code is freely available, and that it can be modified and shared by members at no cost (Katz 2008; Evans and Reddy 2002; Tirole and Lerner 2000; Weber 2000). In making the movement a reality, Richard Stallman had to create a software development licence that became widely known as a General Public License (GPL). Under this licence he began to create software and made the software freely available for everybody to modify and distribute, but not to resell for profit. These activities took place in early 1989 (Katz 2008), at which time there was a popular free operating system known as UNIX. Under the GPL license, Richard Stallman and the free foundation developers contributed to very important free software, such as the GCC compiler, the GDB debugger, the Emacs text editor and the GNU parts of operating systems, but not the operating system itself (Weber 2000; Katz 2008).

One of the criticisms that Richard Stallman and the Free Software Foundation received was with regard to their stand on the non-involvement of commercial proprietary software. Although it would have made sense to integrate free software and proprietary software in creating an even better product, some developers believed that, at that time, proprietary software was technically good (Weber 2000). This then led to another movement called open source (OS), which allowed the GPL and followed the same principles as the Free Software Foundation but differing in a manner that OS can be sold and distributed at a fee. In analysing the behaviour of OS developers, Ghosh, Glott, Krieger and Robles (2002) found that the work developing between the OS community and the Free Software Foundation community was basically the same. The only difference was the principles that guided them.

According to Tirole and Lerner (2000), Weber (2000) and Katz (2008), the rise of the Internet in the early 1990s was the main facilitator of the OS movement. As the OS movement is largely dependent on communication among developers, the Internet has helped in the growth of the most popular OS project, Linux. The literature mentioned above tells of how Linux

started with one university student (Linus Torvalds) who, using the Unix operating system, developed a kernel for the Linux system. After the system had showed signs of its effectiveness, he decided to release the code using an Internet newsgroup, and to allow developers across the world to contribute to the project. Later that year, Torvalds received more than 100 responses from various developers who contributed to the project. As time went by the number of developers increased and, by 1994, Linus Torvalds had released the first version of the OS project known as Linux, version 1. This was the first version of the popular OS operating system, which today has been adopted throughout the world.

The following section provides a literature overview on the different ways in which OS has been promoted. These are not necessarily applicable to Tanzania.

2.5 Open source promotion

In this section general OS promotional activities are explored. An investigation into OS promotional activities is necessary because the study assesses the promotion of OS as a strategy to address ICT acceptance challenges.

The term *promotion* as used in the present investigation refers to *the attempt to make practitioners and the general public aware of the existence of OS and the merits associated with its use*. In order for OS to address the perceived ICT acceptance challenges, strategies have to be put in place and efforts made to make the public aware of its existence, as well as the benefits associated with use of OS rather than proprietary software. The following sections specifically discuss the strategies identified in the literature that have been used in different parts of the world.

2.5.1 Formation of open source communities

OS communities are groups of people who contribute to the public good of OS software by writing software code for the project (Lakhani, Spaeth and Von Krogh 2003). However, Stam (2009) views an OS community as a “technical community” because individuals only contribute by providing software code. OS communities comprise key players that are summarised in Table 2.3, which is based on the studies of Singh (2005) and Nakakoji, Yamamoto, Nishinaka, Kishida and Yunwen (2002).

The individuals in a community voluntarily collaborate on an initiated project using various Internet communication tools (Sturmer 2005). Monetary rewards are not supposed to be motivational factors that lead individuals in OS communities to contributing code and support (Bonaccorsi and Rossi 2006). Accordingly, the motivation for doing so includes gaining reputation among one's peers, increasing and developing skills from a wide range of developers, improving existing programs and an opportunity for talent recognition by top companies.

Table 2.3: Open source community stakeholders

| OS Community | Roles | OS Project | Reference |
|----------------|---|------------------|-------------------------|
| Leaders/Owners | Initiate the project and have vision and direction of project | Software Project | Sturmer 2005, Nakakoji, |
| Core Members | Longtime coordinators of a project | Documentation | Yamamoto, |
| Developers | Contribute code and fix bugs that may arise during development | | Nishinaka, |
| Readers | Like peers reviewers, they read code and try to understand how it works | | Kishida, |
| Passive Users | End users who use the system once it is complete | | Yunwen Ye |
| Active Users | Have same role as readers | | 2002 |

Furthermore, another reason why individuals contribute to OS is the need for personal choice software (Shah 2006). In fact, the common goal of an OS community is to improve collaboration on the project in hand (Sturmer 2005).

Table 2.4 lists of some OS communities in various countries.

Table 2.4: Examples of open source communities

| Community | Description | Reference |
|--------------------------|---|----------------------------------|
| <i>LUGs</i> | Linux user groups (LUGs) are groups of individuals found in various countries that are committed to promoting Linux and OS software. | Srivastava and Srinivasan (2009) |
| <i>FOSSCET, India</i> | This OS community offers classes on OS topics at Trivandrum, college of engineering. | Srivastava and Srinivasan (2009) |
| <i>GLUGOT, India</i> | This community organises an annual software freedom day and holds weekly meetings in an effort to promote OS across all universities. | Srivastava and Srinivasan (2009) |
| <i>OSBR, Canada</i> | This is a community that produces a monthly publication on OS topics for all business owners, company executives, employees, directors, other OS communities and project leaders who are interested in the OS movement. | Srivastava and Srinivasan (2009) |
| <i>Linux Australia</i> | A body of Linux user groups in Australia and a broader free and OS software community across Australia | Waugh (2008) |
| <i>OSIA</i> | OS Industry Australia is an association of organisations developing and selling OS software solutions to all sectors of the economy. | Waugh (2008) |
| <i>TAFOSSA, Tanzania</i> | Aims at creating awareness, building local capacity and coordinating development of free OS software in Tanzania. | TAFOSSA (2006) |
| <i>TLUG,</i> | Tanzania Linux User Group promotes the use of | Tanzania Linux User |

| | | |
|------------------------------------|---|------------------------------------|
| <i>Tanzania</i> | Linux operating systems and other OS software. | Group (2010) |
| <i>Kilinux, Tanzania</i> | A localised project that promotes the translation of OS software into the local Swahili language. | Kilinux (2010) |
| <i>Ubuntu Tanzania Association</i> | Promotes Linux Ubuntu software by providing help and support, as well as acting as a point of contact between Tanzania and the rest of the Ubuntu community across the world. | Ubuntu Tanzania Association (2010) |

2.5.2 Community collaborative tools

OS communities are not limited by geographical boundaries and are enabled by various technological communication tools. Table 2.5 provides a description of commonly used tools, as described by Gupta et al. (2009).

Table 2.5: Some collaborative open source tools

| Tool | Description |
|---------------------------|---|
| IRC (internet relay chat) | An internet application that allows synchronised instant chatting between groups or individuals. |
| Mailing list | A list of email addresses of interested parties to a discussion topic or project. |
| Wiki | A webpage that contains information for everybody to view; it can be modified, deleted and updated so as to give proper information. |
| Blog | This is similar to a website that allows members to post and view messages on its pages. Other multimedia types of information (audio, video and images) are also important contents on a blog. |

2.5.2.1 Internet relay chat (IRC)

IRC is a chat system that lets a user connect to a network of IRC servers and participate in live discussions (Golbeck and Mutton 2004). Using a set of IRC servers, the form of discussion is mainly text based (Xakaza 2006). In this case, a large number of users connect via a channel without having to register or sign in for authentication. *Channels* here refer to available discussions lists that have been created by users for discussion (Haveliwala 2002). Discussions can take place at any time provided a user with an IRC client is able to connect to an IRC server.

An article by Cisco Systems (2009) relates IRC tools to Instant Message tools (IM). While both tools are used by millions globally, there is a slight difference between the two. With IM, a user has to be invited and accepted before joining the discussion, while with IRC chat rooms a user simply joins the discussions after being connected by a server. Nevertheless, there is a similarity in that in IRC, in order for instant messaging to work, an IM server is required to exchange information and give feedback to IM clients.

2.5.2.2 Mailing lists

A mailing list is a technological tool that allows individuals to post messages to all other members of those electronic mailing lists by sending one email message (Allen and Slutsky 2003). By sending an email, the task can be moderated or otherwise (Xakaza 2006). Consequently, moderated mailing lists allow the moderator to review and validate the email before it is sent. However, this differs in the case of mailing lists without a moderator.

In describing its usage, Coita and Abrudan (2007) mention communication as one of the best features of mailing lists. Communication using mailing lists is efficient in encountering new members and sharing information, and ensures privacy within the group is not bounded by time and location and preserves the values and culture of the members.

2.5.2.3 Wikis

A wiki is a set of linked web pages created through incremental development by a group of collaborating users; it is also the software used to manage a set of web pages (Wagner 2004).

Since Wikis are collaborative tools, Leuf and Cunningham (2001) view their existence as an advantage, as they create an environment in which knowledge is shared by people who have

information. As more materials are added, wikis tend to grow and evolve at the same time, removing the barriers of time and location to accessing information. On the other hand, wikis have been criticised in the sense that free manipulation of the information on sites may pose risks to the information already posted (Leuf and Cunningham 2001).

2.5.2.4 Blogs and discussions forums

OS communities rely heavily on discussions forums, making them the essence of such communities (Helic, Maurer and Scerbakov 2004). For example, a group of software programmers can exchange ideas online by posting code and video-based training for the members to view.

Accordingly, discussion forums may be defined as the use of Internet facilities/software that allows the posting of topics, text and multimedia-related sources for members to view.

Discussion forums are sometimes referred to as web forums, message boards, discussion boards and bulletin boards (Coita and Abrudan 2007). Since discussion forums cater for a certain group or system (Helic et al. 2004), they need a moderator who organises the discussions, orders the interventions and establishes the arguments to lead to a decision. Unlike other forums of online communication (IRC and IM), discussion forums contain structured, moderated discussions (Attardi and Zorzetti 1999).

2.5.3 Promotion with government support

Since governments are the biggest consumers of software, there is a need to emphasise their engagement in OS. This is especially true if OS adoption is to increase and is to be used at all levels (Evans and Reddy 2003). Some governments have recognised that OS projects assist in reducing the cost of acquiring software (Hansen, Kohntopp and Pfitzmann 2001).

In Europe, various governments have benefited from their engagement with OS (Evans and Reddy 2003). Germany, in its support for OS, has stressed security, stability and privacy concerns of Linux operating system over the much dominant proprietary software. On the matter of cost saving, German-funded researchers have shown that the government could save the federal government 130mil pounds and 2.6 billion pounds country wide if using Linux operating system over proprietary systems. Other examples of government benefits from OS include the following (Evans and Reddy 2003):

- Reducing software independence on a single vendor.
- Initiating software and technological innovation.
- Encouraging local IT development.
- Increasing competition which, in the long run, will reduce purchasing costs.
- Improving software quality.

The E-commerce and Development Report produced by the United Nations in 2003 emphasised the use of OS for ICT policy and development (United Nations 2003). The report suggested two ways in which OS could be promoted by government involvement: government could have either a *formal involvement* in OS or a *direct strategic involvement*.

In terms of a *formal involvement*, governments could consider using OS as an alternative to proprietary software. Accordingly, governments produce policies and provide the legislation to enable the use of OS in the public sector and social services (United Nations 2003). While this ensures the promotion and growth of OS, Evans and Reddy (2003) argues that in some cases, governments fail to monitor and facilitate industrial policies. Evans and Reddy (2003) argues that some industries such as the software industry are better off without government interference.

In terms of a *direct strategic involvement*, governments act as procurers or purchasers of software and may provide the finances to promote OS. The main task here is to create strategic policies that will assist in promoting and creating awareness of the technology at both the industry and the civil level. Accordingly, government creates a collaborative environment in which developers, donors and other established companies can come and work together in the development of OS technology. To illustrate one such strategic involvement, the United Nations (2003) report gave an example of the Free and OS Software Foundation for Africa (FOSSFA), a collaborative body that aims at promoting and creating awareness of OS technology in member countries. Table 2.6 gives a list of examples of governments and their involvement in OS software.

Table 2.6: Government involvement in open source promotion

| Government | Examples of OS involvement | Reference |
|-------------------|---|---|
| Germany | Federal Institute for Agriculture and Food and the administration of the German parliament (Bundestag) have implemented OS operating systems on servers and workstations. | Weber (2004); Lewis (2008); Ouédraogo (2005) |
| Britain | The government sponsors research on OS in the public sector at its national computing centre. | Lewis (2008) |
| South Africa | The Department of Health has implemented an OSFS health information system in both national and provincial departments. | Weber (2004); UN (2003) |
| Australia | Department of State and Regional Development supports the OS industry and community report. | Waugh (2008); Ouédraogo (2005) |
| Brazil | A law has been passed to make the use of FOSS mandatory in government agencies and non-governmental organisations in Rio Grande so soul | UN (2003), Evans and Reddy (2003) |
| Malaysia | Government commitment in 2001 to the use of FOSS in key agencies like the treasury. | United Nations (2003); Lewis (2008); Ouédraogo (2005) |
| India | Promotion of Indian language computing through OS. | United Nations (2003); Lewis (2008) |
| Venezuela | The government has announced that all government software that is developed must be done so under the GPL licence. | Evans and Reddy (2003); Ouédraogo (2005) |

| | | |
|----------------------------|--|--------------------------------------|
| Kenya, Tanzania and Uganda | The government ICT policy calls for utilisation of OS technology. | Chonia (2003); Lewis (2008) |
| Italy | In October 2002 the government established a committee of experts on OS. | Ouédraogo (2005) |
| Japan | Japanese OS policy is described on the Ministry of Economy and Trade and Industries website. | Ouédraogo (2005) |
| Tunisia | In July 2001 the government established an OS policy. | Ouédraogo (2005) |
| France | Some of the government key departments have adopted OS operating systems. | Evans and Reddy (2003); Lewis (2008) |

2.5.4 Promotion by private firms

Bonaccorsi and Rossi (2005) suggest that the main interest of private firms in the OS community is to reap the monetary rewards that may accompany their involvement. The firms may profit from OS as they are able to reduce the production costs that arise from paying the high licence and purchase fees involved when buying technology from proprietary vendors. The United Nations (2003) argues that commercial companies frequently review the technology contributions made by individuals collaborating together in a community. Consequently, OS communities and programmers stand a high chance of receiving finance and attracting attention from venture capitalists (United Nations 2003).

In conducting their OS awareness campaigns and promotional efforts, OS communities have need of financial assistance from both government and the private sector. At the end of the day, it is these big purchasers of software that will become the end-users of OS software. Hence, there is a great need for OS communities to develop partnerships with private firms. In terms of such partnerships, OS communities receive development finances while private firms wait for the end result, which might assist the private firms in reducing production

costs. Sometimes managers of private firms review the ongoing contributions that are being made by developers in order to identify likely ICT experts and offer them employment. Table 2.7 gives examples of OS involvement by some popular private and public ICT companies.

Table 2.7: Open source practitioners (E-commerce and Development Report 2003)

| Company | OS involvement |
|---------------------|---|
| IBM | IBM hosts a variety of OS projects, all under OS licence approved by the OSI. |
| MICROSOFT | Microsoft Interix technology, now integrated into Windows services for Unix 3.0, provides an environment under GPL licence for running both Windows and Unix applications on a single system. |
| PWC | OS topics are discussed on site from a consulting perspective. |
| ORACLE | Oracle has ported database products for Linux. |
| HP | HP hosts several OS projects. |
| ACCENTURE | OS topics are discussed on site from a consulting perspective. |
| SAP | The mysap business suite runs on Linux. |
| HITACHI | Hitachi participates in OS projects. |
| SUN MICROSYSTEMS | Sun sponsors a number of OS projects, including open office.org and netbeans. |
| COMPUTER ASSOCIATES | This is a co-founder of the OS development lab. |
| ADOBE | Uses python plug-in and an OS programming language for its Adobe products. |
| APPLE | Darwin, which is under the Apple public source licence, is the core of Apple's Mac OS X operating system. |

2.6 Determining the gap

This chapter reviewed ICT acceptance challenges and presented theoretical models of technology acceptance. The moderators and determinants of ICT acceptance challenges were then discussed and related to technology acceptance factors from the theoretical models.

Based on the premises that (a) ICT is a driver of economic development and (b) OS can be an important strategy in trying to foster the acceptance and use of ICT, the promotion of OS becomes important. In short, OS has been seen as an approach to ICT usage and dissemination that has the potential to address the challenges facing ICT acceptance in developing countries and in Tanzania in particular.

As already stated, this study assumes that ICT acceptance precedes ICT usage and, in Tanzania specifically, some OS communities have been established with a view to nurturing OS in the country. Currently, there would seem to have been no similar studies conducted and there has been no study in Tanzania to assess OS promotional efforts in relation to ICT acceptance challenges in that country. Such a study is important since it could point to a number of positive and negative aspects of OS promotional strategies that could guide future decisions and practices, specifically with regards to ICT acceptance challenges.

2.7 Summary

This chapter reviewed ICT acceptance challenges in general, and in Africa in particular. Furthermore, a brief overview of the relevant technology acceptance models was provided. The historical background of OS was also presented and, finally, the gap in the literature that this study aims to address was identified. In Chapter 4, the issue of ICT acceptance challenges will be discussed from a technology acceptance perspective and the ICT acceptance challenges relevant to this study as the first contribution of the research. In the following chapter (ch 3), the research approach and methodology adopted for the study is presented.

CHAPTER THREE: RESEARCH METHODOLOGY

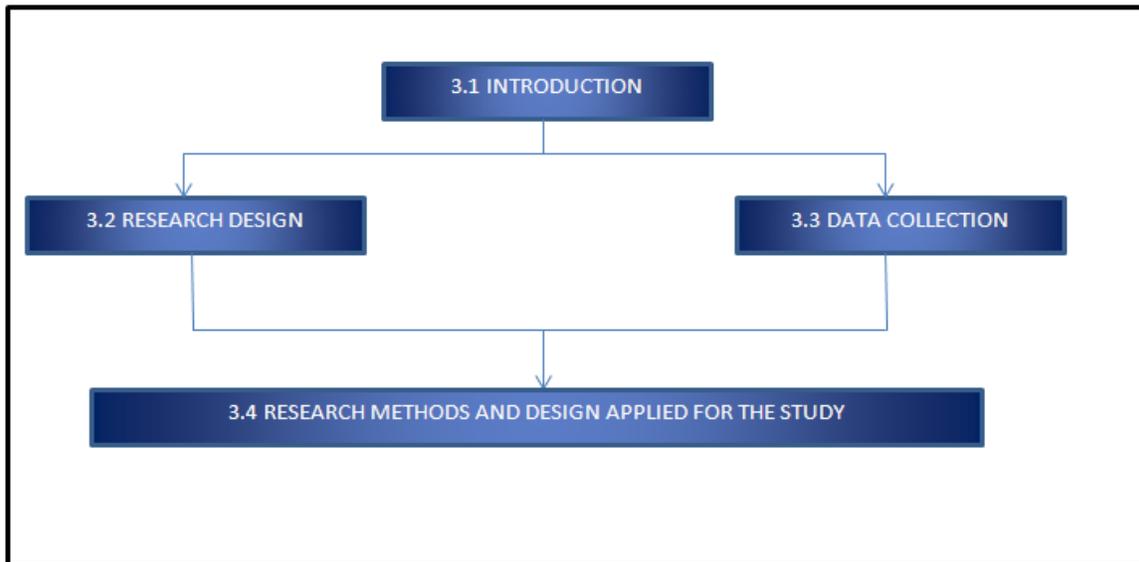


Fig 3.1: Chapter map

3.1 Introduction

This chapter presents a description of the research methodology. Section 3.2 provides a brief overview of the research design in general, and the research approaches and research strategies are discussed in sections 3.2.1 and 3.2.2 respectively, while the data collection procedures are described in section 3.3. Finally, the research methods and the design applied to this study are explained in section 3.4.

3.2 Research design

According to Leedy, Paul, Ormrod and Jeanne (2001), a research design is a set of careful plans developed by a researcher to provide criteria and specifications according to which the research is to be carried out. This means that a research design depends on the nature of the investigation that is expected to be carried out. The literature shows that there are various types of design in ICT research (Gallupe 2007; Goede and De Villiers 2003; Oates 2006). Each research design is based on a particular approach to truth and understanding, which has related research strategies and data capturing methods. The research approaches are discussed in more detail in section 3.2.1, research strategies are discussed in section 3.2.2 and, finally, data capturing methods are discussed in section 3.2.3.

3.2.1 Research approaches

On a philosophical level, research can be classified as *positivistic*, *interpretive* or *critical* (Goede and De Villiers 2003), which can be explained as follows:

- *Positivistic* methodologies are characterised by evidence of formal proposition, quantifiable measures of variables and hypothesis testing of a sample that represents a certain population. Experiments are one examples of these (Oates 2006).
- *Interpretative* research methodologies focus on the social aspects of human thinking and the understanding of these phenomena. Examples in this category include case studies, action research, surveys, ethnography and experiments (Oates 2006).
- *Critical* research methodologies are applicable to research viewed as social critique, whereby the restrictive and alienating conditions of the status quo are brought to light (Denzing and Lincoln 1994).

Another distinction that can be drawn between research methodologies is that between *quantitative* and *qualitative* approaches (Gallupe 2007). *Quantitative* research deals with numbers and is usually related to a positivistic philosophy, while *qualitative* research pertains to aspects that cannot be dealt with using numbers, such as feelings, emotions, opinions and thought processes, which could also relate to an interpretivistic philosophy. More recently, the mixed method research approach has been proposed in that it attempts to respect the wisdom of both of the quantitative and the qualitative viewpoints, while seeking a workable solution for the research problem under consideration (Johnson, Onwuegbuzie & Turner 2007).

3.2.2 Research strategies

The present study investigates OS promotion in relation to ICT acceptance challenges in Tanzania in order to ascertain the relevance of the promotion in addressing existing ICT acceptance challenges. The research question could not be answered by taking a purely positivistic stance, as there is no universal truth to be sought. Rather, an understanding of the context and the influencing factors involved is more appropriate for addressing the research questions; hence, an interpretivistic qualitative research approach was adopted.

In terms of the context of the study, as described in Chapter 2, the most important research strategies that should be considered are case studies, surveys, action research and ethnography. These research strategies will now be discussed in detail in the following sections.

3.2.2.1 Case studies

A case study is an in-depth study of a person or group (Yin 1994; Stake 1995). In a case study every aspect of the subject's life, circumstances and history is analysed to seek patterns and causes for behaviour. The hope is that learning gained from studying one case can be generalised to many others. Some of the merits associated with case studies are as follows:

- Case studies are useful in the study of information systems development, implementation and usage in a field (Darke, Shanks and Broadbent 1998).
- Case studies use various data collection techniques (observation, questionnaires, document and interviews) (Darke et al. 1998; Neale, Thapa and Boyce 2006).
- Case studies can be used during research to both develop theory and test theory (Oates 2006; Darke et al. 1998).
- Case studies provide an in-depth understanding of the problem under investigation by describing characteristics and relationships among the variables (Oates 2006).

Case studies also have their disadvantages, most notably:

- Data collection in case studies can be very time consuming and leads to large volumes of data, which makes it difficult to analyse and interpret (Oates 2006; Darke et al. 1998).
- There are limitations on the validity of the case study because the data collection and analysis process are subject to the influence of the researcher's background and assumptions (Darke et al. 1998).
- Case studies are criticised for their overreliance on qualitative data for analysis and interpretation. Often these methods are not well established as compared to quantitative

and scientific ways of evaluating findings and conclusions (Darke et al. 1998; Neale et al. 2006).

- Compared to scientific research approaches, case studies are difficult to generalise from one case to another (Neale et al. 2006).

3.2.2.2 Ethnography

Ethnography is an approach to research that studies a cultural group or system using field work (Riemer 2008). The roots of ethnographic research have been traced back to the fields of anthropology and sociology (Whitehead 2005). The most essential part of ethnographic research is the field work (Whitehead 2005). Field work is defined by Wolcott (1995) as a personal engagement by a researcher in an ongoing social activity done by an individual or a group. Some characteristics of ethnography are the following:

- Ethnography tends to describe and extend a social theory by focusing on a cultural interpretation of a social group (Riemer 2008; Whitehead 2005).
- Ethnography involves the use of multiple data sources and data collection to increase the validity of findings and interpretations (Riemer 2008).
- Using ethnography, studies are done in their natural setting rather than experimentally, which requires the researcher to prepare the environment (Genzuk 2003).
- The data collection process of ethnography is unstructured and does not involve systematic planning. No categorisation of data is done prior to collection as data is simply presented in a raw format before being analysed (Genzuk 2003).

Ethnography research has the following advantages:

- Ethnography provides an in-depth understanding of research. The researcher personally immerses him/herself in the activities taking place within a social group. He/she is eventually familiar with the challenges, struggles and frustration, and learns about the characteristics and complex relationships that exist within the social group (Myers 1999).

- Ethnography is believed to be a creative, flexible, iterative learning process (Whitehead 2005).
- Because ethnography provides a deeper understanding of the problem to be investigated, the knowledge created in the field challenges assumptions that are held by researchers (Myers 1999).

However, ethnography also has certain disadvantages, notably the following:

- Ethnography had been criticised for its time-consuming behaviour. Compared to other research approaches, in ethnography it takes a lot longer to understand complex situations and the relationships among them (Oates 2006; Myers 1995).
- Ethnography is also criticised for drawing out the findings, analysis and interpretation, as it takes longer than other approaches (Myers 1995).
- During the course of ethnographic research, the researcher develops a relationship with the informants and this may result in complications in the form of the friendship obligations that may develop and thus influence the findings and conclusion (Riemer 2008).
- Ethnography raises the risk of ethical concerns, since informants risk exposing their social lives or the lives of the community (Riemer 2008).
- Ethnography is sometimes criticised for its lack of breadth, meaning that the approach can only deal with one research at a time owing to its limitations in terms of geographical locations and the time required for research (Myers 1995).

3.2.2.2.1 Data collection in ethnographic research

In a natural setting, a researcher spends most of his/her time observing activities carried out by the individual or group. Data collection by observation has therefore become the basic method for collecting data in ethnography (Riemer 2008). The researcher collects data either as a *participant observer* or a *non-participant observer*. In participant observation, the researcher becomes hands on by engaging in activities to obtain a better understanding and more experience (Oates 2006). A non-participant observes obtrusively, does not take part but

carefully notes down what he/she has observed (Oates 2006). This is done through the use of field notes, recorded tapes and videos, which record all that is carefully observed.

Apart from observation, ethnographic studies collect data by means of *interviews* (Genzuk 2003; Whitehead 2005). The interview process conducted in this respect is less formal and the interviewer has less control compared to the normal structured interview. The interviewee is free to interrupt and ask questions throughout the interview process (Riemer 2008).

Another form of data collection in ethnographic study is the collection and examination of field *documents*. The collected documents are not limited to just public and private texts, but also include multimedia documents like photographs and videos (Oates 2006; Riemer 2008) which are produced by participants in the community in their natural settings. Sometimes documents may also cover a study on published websites (Genzuk 2003).

3.2.2.2 Case study versus ethnography

The main difference between a case study and ethnography lies on the extent to which the researcher immerses him/herself in the field work and the domain which is researched (Myers 1999).

Case studies rely heavily on the use of interviews and field documents as the primary source of data, while ethnography relies heavily on participant observation. In ethnography, data is recorded mostly via field notes and other data recording instruments during the research process (Myers 1999). Unlike ethnographic approaches, case studies are capable of studying one phenomenon across different settings using multiple case studies (Darke et al. 1998). This has been a limitation for the ethnographic approach, which although focusing on a unique phenomenon, does so in one setting for a long duration (Myers 1999).

3.2.2.3 Surveys

A survey is a means of collecting data on the characteristics, actions or opinions of a large population by using a sample (Pinsonneault and Kraemer 1993). This sample is presented by using quantitative data which measures people's perceptions, opinions, knowledge, attitudes and behaviour (THCU 1999). When a survey is a representation of the total population it is called a *census*, which is a type of survey (Ross, Clark and Renckly 2002).

The collection of quantitative data in surveys has the following advantages:

- *Speed.* Using a sample, representative data is collected in a shorter period of time than it would take to survey the entire population (Ross et al. 2002).
- *Cost saving.* Because the sample selected is small, the costs that accompany data collection are smaller than when handling the entire population (Ross et al. 2002).
- *Multiple data collection instruments.* These include mail surveys, questionnaires, telephone surveys and fax surveys (THCU 1999).
- *Increased accuracy.* Upon analysis and if quantifiably correct, qualitative data provides a true generalisation of the total population (THCU 1999) and (Ross et al. 2002).

One of the disadvantages of surveys is that expert statistical knowledge on sampling, analysis and data interpretation is required in order to obtain correct findings (THCU 1999). Besides, Ross et al. (2002) indicate that surveys run the risk of obtaining insufficient sample sizes, which may cause errors upon analysis. However, the best way to handle such risk is to conduct a survey that comprises the total population (census survey).

A survey uses various data collection instruments; among them is the questionnaire (Marshall and Rossman 2010). A questionnaire consists of a predefined set of questions for a respondent to answer and, hence, provides evidence that can be analysed and interpreted (Marshall and Rossman 2010). Sometimes the terms *surveys* and *questionnaires* are used interchangeably. However, the term *survey* refers to the technique or method used, whereas the term *questionnaire* relates to the actual list of questions.

Marshall and Rossman (2010) identify two types of questionnaire, namely self-administered and researcher administered. In the latter, the researcher asks the respondents the questions and writes the answers down as the respondent replies, while the former does not involve the presence of the researcher. The self-administered questionnaire gives the researcher some advantage in that a large amount of data can be collected without the researcher being present. Moreover, the questionnaire can be sent via post or email.

In this study a questionnaire was used as a data collection technique and was both self-administered as an online questionnaire and researcher administered.

3.2.2.4 Action research

Action research, as an approach to research, aims at taking action and, subsequently, creating knowledge and theories that are derived from that action (Coghlan and Casey 2001). Action research follows a series of five-phase iterative circles, namely *identifying a problem, planning, taking action, evaluating action* (Oates 2006; Baskerville 1999; Coghlan and Casey 2001) and *specifying learning* (Moutz, Moore and Brown 2008). Action research has the following characteristics:

- Action research provides an understanding of a social situation by analysing its social setting and proposing solutions to existing situations within the settings (Baskerville 1999).
- Action research carries out change experiments on real problems by providing practical solutions and scientific knowledge useful in the social context (Coghlan and Casey 2001; Baskerville 1999).
- Action research involves collaborative work between the researcher and the participants, thus enhancing competencies (Oates 2006; Baskerville 1999; Moutz et al. 2008).

3.2.2.4.1 Action research life cycle

The action research life cycle comprises four stages as follows:

- *Identifying a problem*

Sometimes called *diagnosis* (Coghlan and Brannik, 2004), this stage involves the identification of primary problems within the social setting. The diagnosis stage comprises iterative and collaborative work done by the researcher and others within the process. Diagnosis tends to change from stage to stage but records need to be kept every time a change occurs on how this change has led to an alternative diagnosis.

- *Planning*

This step is a continuation of the diagnosis stage whereby the researcher and the participants collaborate using a theoretical framework to plan the desired future state and any changes that might achieve the desired state.

- *Taking action*

The researcher and the practitioner collaborate to implement the planned action. Changes and interventions are expected at this stage.

- *Evaluation action*

At this stage, the researcher and the practitioners collaborate to evaluate the outcomes. The evaluation is based on the determination of whether the theoretical effect on the action has been realised (Baskerville 1999). The outcomes simply measure whether the diagnosis was correct and whether the correct actions were implemented (Oates 2006).

3.2.2.4.2 Participatory action research

Although action research entails collaborative efforts between the researcher and the practitioner, it is seen as more appropriate within the organisational context (Coghlan and Casey 2001). An extension to the traditional action research was therefore developed to provide more focus on the community and social level in order to address some aspects of their settings. Action research was used to address complex political, economic, political and environmental issues within society, such as the power struggles between male and female in decision making (Oates 2006; Coghlan and Brannik 2004).

In participant action research, the researchers become co-researchers working hand in hand with local community members in research activities, using various relevant data collection methods (Moutz et al. 2008). Both sides acquire knowledge that is to be shared among them. An assumption is that the researcher will benefit from having to spend less time on acquiring information about the social settings by simply engaging members of the local community. These are assumed to know much about the setting having spent much of their time within the environment. At the same time, the local community members would benefit from the knowledge gained from the research that the researcher assumes is transferable (Baskerville 1999).

Some of the advantages of action research are as follows:

- Action research encompasses many data collection methods, the choice of which depends on the problem (Oates 2006).

- Action research enhances competencies among practitioners in that they analyse the problem better during research (Abhiyan 2011).
- Since action research is collaborative, it increases ownership of findings among practitioners and increases capacity among participants, as well as training them to tackle problems on their own in the future (Moutz et al. 2008).
- Action research requires reflective critique, seeks to understand complex situations and tends to improve the quality of life in social settings (Abhiyan 2011).

Disadvantages of action research include the following:

- If not done carefully, the collaborative and community engagement with participants might be time consuming and might require more resources (Moutz et al. 2008).
- In action research, the research is a collaborative effort and this might reduce the ability of the researcher to control the research process and its outcomes (Baskerville 1999).
- Owing to its qualitative, interpretive nature, action research lacks criteria for evaluating action, which makes the publication review process difficult. Hence, the approach is not favoured by researchers who are bound to timely releases of work in research journals (Baskerville 1999).

3.3 Data collection

Data is collected by specified procedures known as data collection techniques which are discussed in section 3.3.1. Ethical behaviour should be observed during data collection, analysis, dissemination and storage. This study was evaluated and approved by the School of Computing Research and Ethics Committee (SOCREC). See Appendix 1 for the ethical clearance approval.

3.3.1 Data collection techniques

These are the methods by which field data is produced for evidence, in which case data could be qualitative or quantitative (Oates 2006). Accordingly, one performs a qualitative analysis to ascertain the nature of the attributes, behaviour or opinions of the entity being measured.

On the other hand, one performs a quantitative analysis to ascertain the magnitude, amount, or size, attributes, behaviour or opinions of the entity being measured.

According to Patton (2002), there are four data capturing techniques commonly used in the research process, namely interviews, observations, document analysis and surveys. However, other researchers view surveys as a strategy that uses questionnaires as the data capturing technique. This is the technique used in this study. The four techniques will now be discussed in more detail.

Interview: This consists of open-ended questions and probes that yield in-depth responses about the interviewee's experiences, perceptions, opinions, feelings and knowledge. There are three common types of interview (Harrel and Bradley 2009; Patton 2002):

- *Structured or open-ended interview.* This is the kind of interview in which the researcher asks interviewees the same predetermined questions in the same order. The interviewer is in control of the agenda in at least most, if not all, parts of the interview.
- *Semi-structured interview.* In this type of interview, some questions are asked but the interviewer is free to choose the ordering of questions and the interviewer has the opportunity to ask additional questions based on the responses he/she obtains.
- *Unstructured interview.* Patton (2002) refers to this as a conversational interview in which there is more room for the interviewee to express his/her opinions and ask questions. The interviewer becomes less interruptive and has very limited control over the agenda and the interview questions. The order of the questions does not matter and the interviewee is free to decide which questions to answer and which to skip (Oates 2006).
- *Group interviews and focus groups.* In this kind of interview, the interview process involves obtaining responses from a group of interviewees; any of the three types of interview discussed here, namely structured, semi-structured or unstructured, can be used (Marshall and Rossman 2010; Patton, 2002).

Observation. Observation involves the use of the human's five senses (sight, hearing, feeling, taste and smell) to observe people's actions, rather than relying on what has been reported (Evaluation briefs 2008). Accordingly, observations could be made of activities,

behaviours, actions, conversations, interpersonal interactions, organisational or community processes and any other aspect of observable human experiences. Observation is relevant when

- direct information is needed
- the researcher tries to understand an ongoing behaviour, process, unfolding behaviour or event
- there is physical evidence, products or outcomes that can be readily seen
- procedures for collecting written or other data seem inappropriate.

In this study, observations were made of interactions online through participation, as well as physical visits to actual users for interview purposes. This information, together with the literature analysis, was instrumental in ascertaining the questions that were formulated for the questionnaire and the interviews.

Documents. These comprise data that refers to previous studies or currently available established databases (Oates 2006). Furthermore, these are *found documents*, which existed prior to the research, and are produced by organisations, individuals and publications. *Researcher-generated documents*, on the other hand, only exist because research was undertaken; these include, among others, field notes, photographs, diagrams and videos. Most of these are known collectively as secondary data.

Questionnaire. A questionnaire consists of a predefined set of questions for a respondent to answer and hence provide evidence that can be analysed and interpreted (Marshall and Rossman 2010). Sometimes the terms *survey* and *questionnaire* are used interchangeably. However, the term *survey* refers to the technique or method used, whereas the term *questionnaire* relates to the actual list of questions.

3.4 Research methods and design applied to this study

The research approach for this study is a mixed-methods approach since both qualitative and quantitative approaches were used and the triangulation was done on the data level. This approach was selected because the bias inherent in a particular data source, the investigators

and, particularly, the method will be moderated when used in conjunction with other data sources, investigators and methods (Denzin, 1978). The case studies included four of the OS communities that exist in Tanzania. Case study as a research strategy was selected because, in this research, multiple case studies could be conducted in order to study one phenomenon across different settings (Darke et al. 1998).

The research strategies for data collection adopted for this study include literature analysis, document analysis, observation, interviews and surveys. The literature analysis extracted ICT acceptance challenges in general and specifically those found in the Tanzanian context. Furthermore, the technology acceptance literature was analysed to identify constructs and models relevant to OS acceptance and for providing a succinct set of ICT acceptance challenges in Tanzania, as presented in Chapter 4.

Documents from the OS communities were analysed in order to extract the mission and vision of the respective community and also to identify OS community activities. The information obtained from this document analysis was, in turn, used to develop the questionnaire for the interviews and the survey. The documents were also used to evaluate active projects that had been developed. This guided the researcher and provided him with more detail when approaching the OS communities to gather data using the questionnaire.

As for observation, the researcher joined in as an active member of each of the OS communities (TAFOSSA, TLUG, Kilinux and the Tanzania Ubuntu Association). Observation is *obtrusive* when the people being observed are aware that they are being observed. In this situation, the danger is that the behaviour of the participants may be influenced by the presence of the observer (Steele and Powell 1996). In this study, obtrusiveness was avoided since the researcher subscribed to OS communities as a normal member which anyone can do. Through observation the researcher could observe the actual activities carried out in the OS communities. Being a member meant that the researcher had the opportunity to join the discussion forums and gain access to some of the publications previously released. As a member, the researcher attended the seminars and general meetings on OS matters arranged by the communities. Moreover, the researcher could send the questionnaire online to the OS participants.

Observation was used to note the members' daily contributions via the communication tools. The communication tools provided room for developers to meet and share code and ideas on how to go about carrying out the projects. The researcher, therefore, observed the frequency of topic postings, member replies and member code contributions, and the number of new members joining, as well as determining member frustrations as the projects became complicated. After approximately four months, the researcher developed a questionnaire and sent it to 30 members of the four OS communities. All the members who were approached gave feedback, although not all questions were answered in every questionnaire. The researcher also observed the reception of any project that was installed in the community. Another 10 respondents were physically interviewed using a researcher-administered questionnaire. These respondents were employees of various reputable companies and organisations in Tanzania, and ranged from IT managers to IT end-users. The aim was to evaluate OS usage and promotional efforts at the industry level.

With regards to interviews, the researcher interviewed OS users to obtain in-depth information on their experiences with OS, in particular, their understanding of the functions that OS could supply; their willingness to use OS; the limitations of OS; and their satisfaction with OS promotional activities. The interviews involved only 10 of the 40 informants.

Regarding the survey, open and self-administered questionnaires were distributed via email groups to 30 of the OS team members. The surveys were expected to provide answers to the following:

- Awareness of the OS movement in Tanzania
- List of ICT acceptance challenges in Tanzania
- The extent of the support provided by government and other major ICT stakeholders
- Advantages and disadvantages of OS in Tanzania
- Evaluation of OS promotional activities in Tanzania
- How OS can be promoted as an alternative solution to the existing ICT acceptance challenges in a developing country like Tanzania

The data generated in this study was both qualitative and quantitative in nature. In analysing the data, qualitative and quantitative methods were therefore employed. The qualitative data consisted mainly of a description of the promotional activities and subsequent inferences and conclusions. As for the quantitative data, percentages and frequencies pertaining to different aspects of inquiry were calculated for descriptive purposes. The analysis was then followed by a critical discussion to make sense out of the data. The research questions, objectives and activities are summarised in Table 3.1.

Table 3.1: Relationship between research questions, objectives and activities

| Research question | Objective | Research activities |
|--|--|--|
| 1. What are the ICT acceptance challenges in Tanzania? | To identify ICT acceptance challenges in Tanzania | Literature analysis; interviews; surveys |
| 2. What is done to promote OS in Tanzania? | To identify promotional activities and how they are perceived by the community | Literature analysis, document analysis, observation , interviews and survey |
| 3. How successful is OS promotion in addressing ICT acceptance challenges in Tanzania? | To assess OS promotion in addressing ICT acceptance challenges | Compare the synthesised list of ICT acceptance challenges with the findings on user perceptions of OS promotional activities |

3.5 Summary

In this chapter research approaches and strategies were discussed in general terms before the approaches and strategies adopted for this research study were presented. The research approach for this research is an interpretive, mixed methods approach. The main research strategy adopted is case studies. Although action research and ethnography as research strategies were explained they were not used. Ethnography resembles the case study method in that it applies similar data collection techniques (interviews, document analysis, questionnaires); however, ethnographic research tends to be time consuming and deals only with one case at a time (Myers 1995). For this study, a case study method was adopted

because, in order to generalise the findings on OS promotion activities in Tanzania, various OS stakeholders had to be researched simultaneously. A case study approach was therefore a better option for the study as it allowed multiple OS communities to determine their promotions activities.

Action research, in the form of participatory action research, was discussed since it explores the collaborative effort that generally exists between the researchers and the project practitioners. In this study, the participant observer in the case study resembles a participant action researcher in action research, as they both interact and communicate with the OS members to gather information. However, the researcher did not take part in the promotional efforts like seminars and project implementation, but was involved merely as an observer in the discussions on various topics. Therefore, action research was not applicable.

The research strategies adopted for this study were document analysis, observation, interviews and a survey. The interviews and the survey used questionnaires as the data capturing tool. Accordingly, the questionnaires were designed specifically for this study as no appropriate, standardised questionnaires could be found; information from the literature study, the document analysis and the observations was integrated to develop them. Table 3.2 below summarises the research questions, the research strategies and their respective data collection methods as described in Chapter 3.

Table 3.2: Relationship between research questions, research strategies and data collection methods

| Research question | Research strategy | Data collection methods |
|--|---|--|
| 1. What are the ICT acceptance challenges in Tanzania? | Literature analysis, survey and interviews. Triangulation at data level. | Literature review of OS documents, questionnaire-driven survey and interviews |
| 2. What is done to promote OS in Tanzania? | Observation, survey and interviews. Triangulation at data level. | Document analysis, participant observation, questionnaire driven survey and interviews |
| 3. How successful is OS promotion in addressing ICT acceptance challenges in Tanzania? | Mixed-methods (qualitative and quantitative) data gathered from the survey and the interviews. Triangulation at data level. | Questionnaire-driven survey and interviews |

CHAPTER FOUR: ICT ACCEPTANCE CHALLENGES

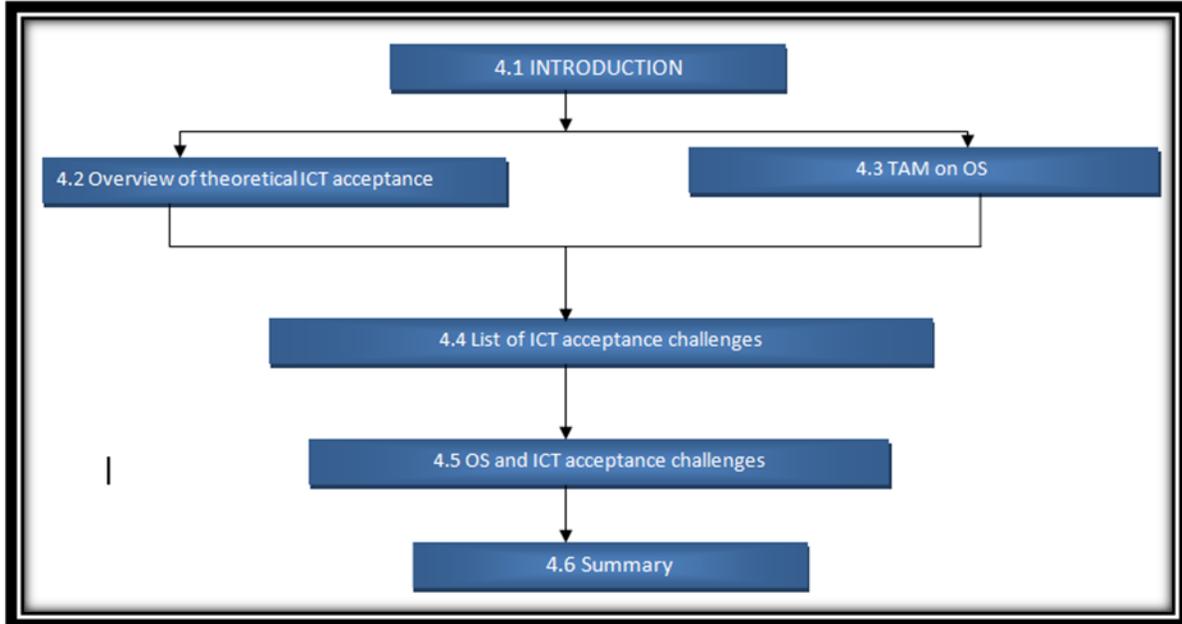


Figure 4.1: Discussion flow for Chapter 4

4.1 Introduction

This chapter provides a discussion on the findings related to the first two research objectives. These findings are fundamental to the assessment of OS promotional efforts in addressing ICT acceptance challenges, which is the final research objective.

As a first step, a synthesis of the technology acceptance models presented in Chapter 2 is provided in section 4.2. Technology acceptance models provide a theoretical basis in terms of which to evaluate the comprehensiveness of the ICT acceptance challenges abstracted from the literature.

Technology acceptance models for OS specifically are discussed in section 4.3.

The first contribution, a list of ICT acceptance challenges in Tanzania, as extracted from the literature analysis, is presented in Table 4.1 and the acceptance challenges are discussed in section 4.4. Finally, the mapping of OS and ICT acceptance challenges is done in section 4.5.

4.2 Overview of the theoretical technology models

As reflected in Chapter 2, a number of theoretical models have been proposed to explain technology acceptance. Since technology is a complex phenomenon and practice, it is difficult to explain every aspect of technology using a single explanation. Some aspects relating to different models tend to be similar to some degree but, more importantly, some features occur across all models while other features may not be represented at all. It is thus imperative to consider different models for comprehensive coverage.

Figure 4.2 is a generalised overview of the combined models as used in this study. This representation is based on the original TAM and also incorporates TAM extensions, UTAUT, ASA and TTF.

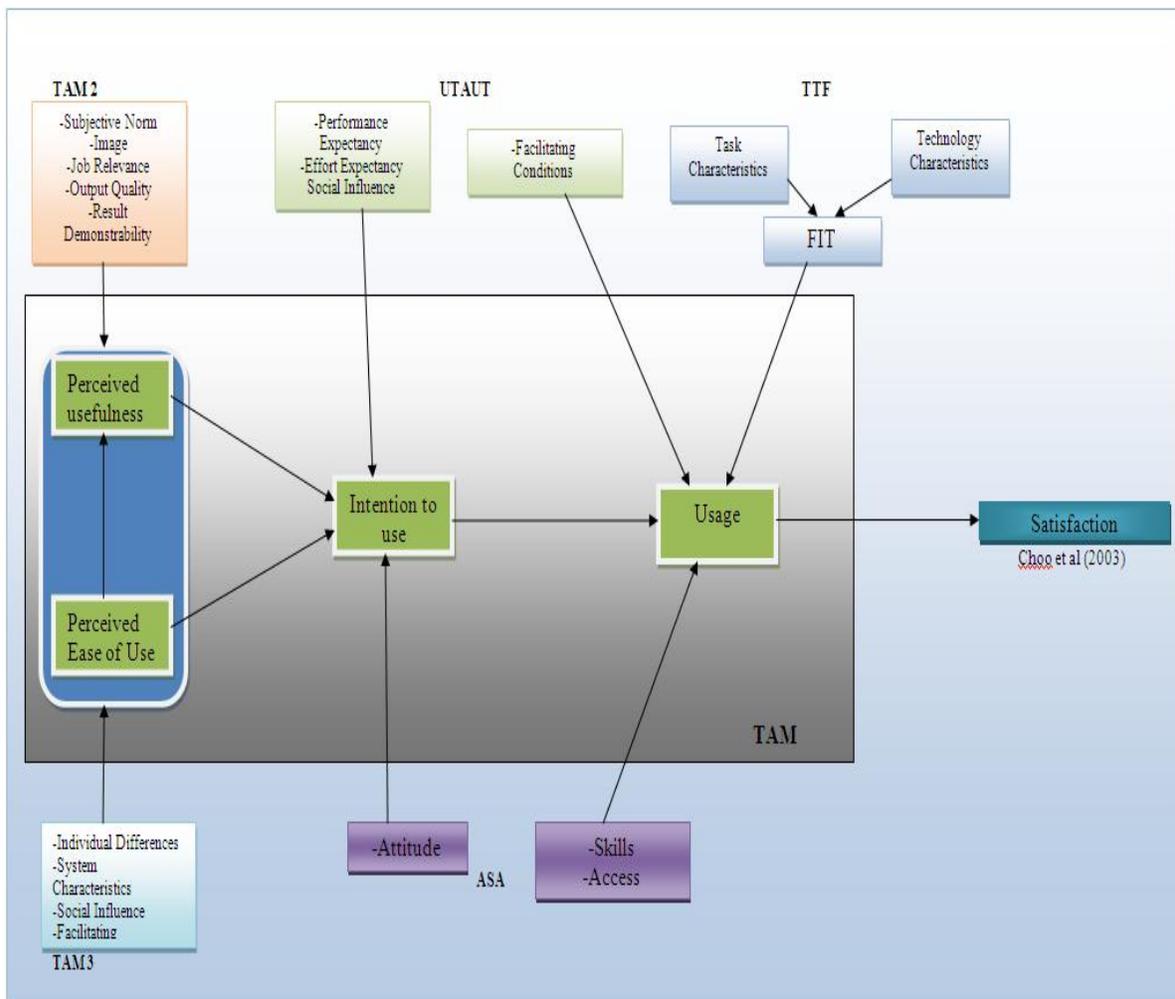


Figure 4.2: Graphical overview of the models studied

4.3 Technology acceptance model on open source

Acceptance determinants for OS have been proposed in order to measure OS success (Lee et al. 2007), OS organisational adoption (Dedrick and West 2003) and OS user acceptance (Galleno, Luna and Bueno 2008). These determinants are derived from the characteristics of OS that have influenced its popularity. Upon measuring OS success, Lee and Cole (2003) mention four determinants of OS success, which include: *software quality*, *community service quality*, *user satisfaction*, *OSS use* and *individual net benefits*. In their findings, Lee and Cole (2003) conclude that *software quality* and *community service quality* have a positive influence on *user satisfaction* and that *software quality* and *user satisfaction* have a positive influence on OS usage. They also conclude that both *OS use* and *user satisfaction* have a positive influence on *individual benefits*. On the other hand, they contradict the notion that the presence of an online OS community would influence OS usage. Lee and Cole (2003) found that the quality of an OS community service has no significant effect on OS use.

Gallego et al. (2008) created another model based on TAM for measuring OS acceptance among users by providing additional determinants. These determinants are called external variables and are derived from the characteristics of OS. They include *software quality*, *system capability*, *social influence* and *software flexibility*. The findings of these authors conclude that OS that is of high quality, highly capable and flexible, is easy to use and therefore likely to be useful. Hence, they confirmed the hypothesis that the determinants *system capability*, *software quality* and *software flexibility* will have a positive influence on *perceived ease of use* and *perceived usefulness* addressed by TAM. On the other hand, the findings contradict the hypothesis that *social influence* will have an influence in the decision to use OS. It has been confirmed that the decision to use OS is independent of the environment that the user finds him/herself in (i.e. social OS community). This decision is influenced by other motives such as the search for reputation or the search to acquire IT skills.

When an organisation decides to adopt OS, Dedrick and West (2003) mention a number of important factors to consider, such as software and hardware costs, reliability, compatibility, trialability, innovativeness and support infrastructure, which have a positive influence on OS adoption. The literature on acceptance determinants for OS mentions that the potential

characteristics of OS influence the determinants of ICT acceptance, that is, social influence, facilitating conditions (*UTAUT*), perceived usefulness (*TAM*) and technology characteristics (TTF). It is from these assumptions that the study on OS promotion, advocating such characteristic, are evaluated to assess whether they address ICT acceptance in Tanzania. Figure 4.3 is a depiction of OS characteristics in relation to the IT acceptance models. This figure is based on the preceding literature survey

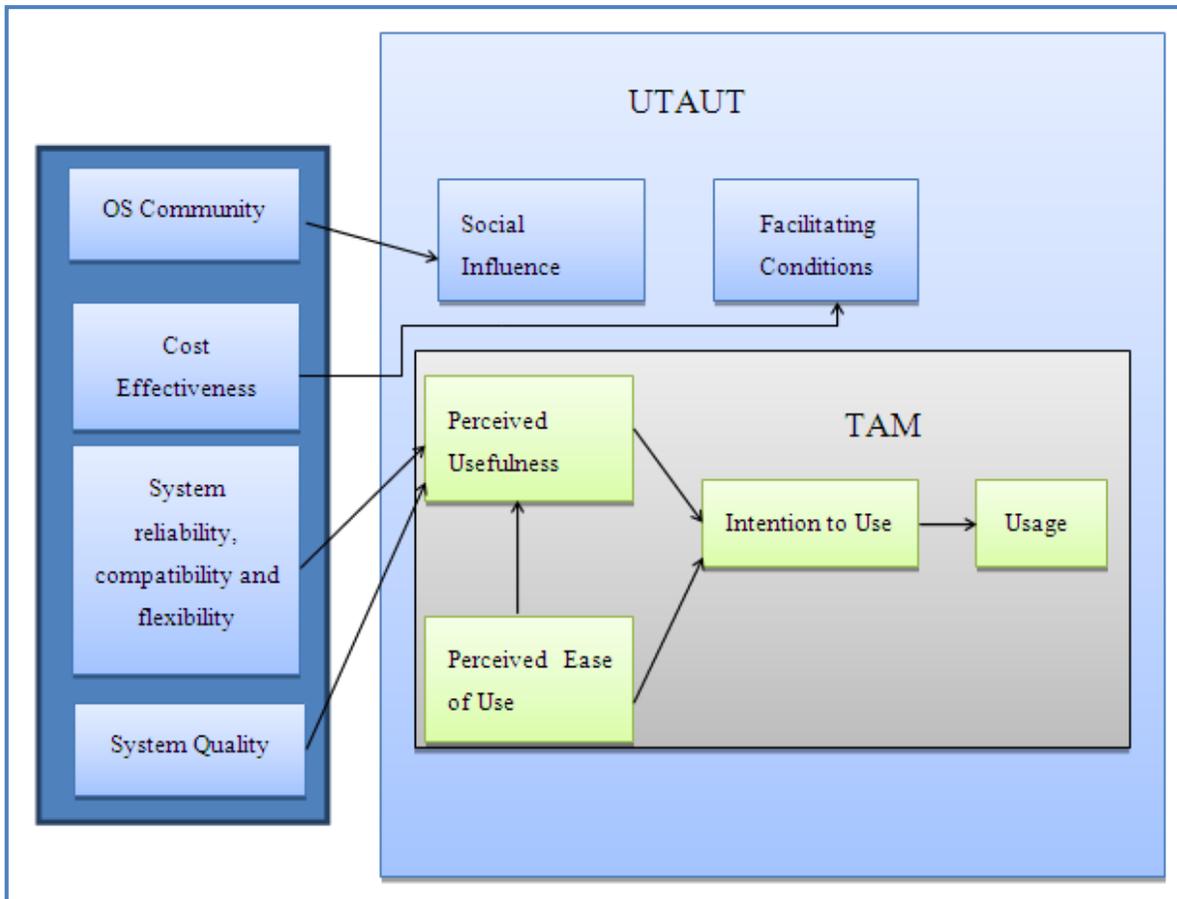


Figure 4.3 TAM for OS

As presented in Figures 4.2 and 4.3, ICT acceptance challenges are well understood if what influences ICT acceptance is known. As a first step, ICT acceptance challenges in Tanzania were extracted by conducting a literature analysis.

Research on ICT acceptance has produced extensions to some of the existing models by adding various moderators and determinants in an attempt to explain user behaviour in terms of the user's decision to use and accept technology. Moderators are regarded as factors that

influence ICT acceptance determinants, while determinants are regarded as parameters that influence technology acceptance in terms of the actual adoption decision (Verdegem and Marez 2008; 2011). Among the frequently mentioned moderators of ICT acceptance determinants are *age, gender, experience* (Venkatesh and Massingue 2003), *complexity, culture* (Schepers and Wetzels 2006), *organisation support* (Magni and Pennarola 2008), *education and training* (Hamner and Qazi 2009) and *computer skills* (Anandarajan et al. 2002).

Using the described models and with reference to the reviewed literature, the moderators of ICT challenges in Tanzania are linked to the determinants of ICT acceptance. Table 4.1 shows the relationship between the ICT acceptance challenges in Tanzania, moderators, the determinants and the models to which the challenges directly relate. In the sections that follow, a more detailed explanation of the moderators is given.

Table 4.1: ICT acceptance challenges in Tanzania: moderators, determinants and models

| Moderators | ICT acceptance determinants | Model | Reference |
|-----------------------------------|---|---------------|--|
| ICT challenges in TANZANIA | | | |
| 1.Donor dependency | External variables | TAM | Magni and Pennarola 2008, Venkatesh and Massingue (2003) |
| Local ICT manufacturing | Facilitating conditions | UTAUT | |
| Private sectors | Perceived usefulness | TAM | Davis (1989) |
| Research institutions | | | |
| 2. ICT experts | | | |
| Training | External variables | TAM | Hamner and Qazi 2009, Verdegem and Verhoest 2008; Anandarajan et al. 2002; Goodhue and Thompson 1995; Davis (1989) |
| Skills | Perceived ease of use, skills, task characteristics | TAM, ASA, FIT | |
| Education | Attitude towards using | TAM | |

| | | | |
|---|-------------------------|-------|--|
| 3. Culture | | TAM | Anandarajan et al. 2002; Davis (1989) |
| Language | | | |
| | Social pressure | UTAUT | |
| 4. Low income | Performance expectancy | UTAUT | Magni and Pennarola 2008; Hamner and Qazi 2009 |
| Cost | External variables | TAM | |
| | | | |
| 5. Infrastructure | Facilitating conditions | UTAUT | |
| 6. Lack of ICT awareness | | | |
| 7. Poor information and illiteracy | | | |

As depicted in Table 4.1, the ICT acceptance challenges in Tanzania are well captured by the technology acceptance models reviewed in Chapter 2. In the sections that follow we discuss the ICT acceptance challenges in Tanzania in more detail and, where relevant, relate them to the technology acceptance models.

4.4 List of ICT acceptance challenges in Tanzania

This section discusses the ICT acceptance challenges in Tanzania as extracted by a literature analysis. The acceptance challenges are discussed under the subsection headings.

4.4.1 Donor dependency

Donor dependency has been mentioned as one of the ICT acceptance challenges in Tanzania. There are generally few local ICT manufacturers, with the private sector being largely dependent on the importation of ICT from outside the country (Mushi 2007). The established research institutions also depend on funds from donors to be able to operate. Magni and

Pennarola (2008) call these moderators *facilitating conditions* in the decision to use ICT. These moderators are also regarded as *external variables* by the TAM model. According to Davis (1986), *external variables* includes the environment and conditions to which ICT products will be developed. If these external variables (small number of local ICT manufactures and the private sector dependence on outside manufacturers) are not conducive to the innovation of ICT products, this will have a negative effect in the *perceived usefulness* of the ICT products (Magni and Pennarola 2008).

4.4.2 Lack of ICT experts

Hamner and Qazi (2009) mention the level of education and training of individuals as a factor influencing intentions to use ICT products. In expanding the TAM, Hamner and Qazi (2009) added a determinant called *perceived personal utility*, which describes the measure of happiness and satisfaction obtained in using the system. These authors argue that the level of training and education will have a positive impact on *perceived personal utility*. On the other hand, *perceived ease of use* in the TAM model is positively influenced by the skills the individual has in using ICT (Anandarajan et al. 2002). These skills are regarded as the know-how to build ICT applications and assisting end-users to use the applications (Prasad 2009).

4.4.3 Culture

Anandarajan et al. (2002) emphasises the modification and management of ICT for different cultural contexts. These authors mention that, depending on the culture, *social influence*, as a determinant of ICT usage, affects the attitude and behaviour of individuals differently in various societies. Other ICT acceptance determinants that are affected by culture, depending on the society, are *perceived ease of use* and *perceived usefulness*. This finding was obtained by Schepers and Wetzels (2006) in their investigation into the effect of culture in Western and non-Western countries.

4.4.4 Low income and cost

Magni and Pennarola (2008) and Hamner and Qazi (2009) mention cost in terms of purchasing power for ICT products as a moderator in the determinant of ICT acceptance. In other words, low compensation of employees will have a negative effect on the affordability

of technology. This means that even if employees need the technology, they will lack the ability to pay the costs involved. Eventually, this will affect the attitude towards usage of the technology, as it will be regarded as unaffordable and thus out of reach (Magni and Pennarola 2008; Hamner and Qazi 2009).

4.4.5 Lack of ICT awareness, poor information and illiteracy

Lack of ICT awareness, poor information and illiteracy have been identified as challenges facing ICT acceptance, and measures meant to address ICT challenges should be expected to address these challenges as well (Scacchi 2007). One of the solutions that Scacchi (2007) proposes is the creation of social networks that promote ICT so as to bring about awareness through online discussions on websites, portals and forums. In this case, developers and interested parties would meet and share ideas on how to improve their development skills.

Carmichael and Honour (2002) support the idea of online discussions and believe that the discussions tend to facilitate the creation of various alliances and promote community developments. These OS practices have, therefore, been identified as the best way in which to promote global ICT awareness, in contrast to proprietary software (Oates 2006; Bourque, Dupuis, Abran and Moore 2004). In a country like South Africa, Van Belle and Ellis (2009) view proprietary software licences, which deny access to the source code, as a barrier to technological innovation. OS software, on the other hand, is viewed as a perfect tool for innovation and for the transfer of programming skills and could provide South Africa with a better way to establish ICT infrastructure in the country.

It has been argued that large commercial organisations and proprietary products have not contributed to a great extent to ICT education and the formation of online forums and portals. Indeed, it has been noted that the availability of freely downloadable programs is the best way to gain access to and be actively involved in ICT practices (Biswas and Singh 2006). Biswas and Singh (2006) are of the view that large communities act as peer reviewers of documents and resources online and, thus, increase the quality of the available information.

In the next section, the ICT acceptance challenges in Tanzania, as extracted from the literature analysis, are analysed in relation to the characteristics of OS. The aim is to provide

insight into the way OS could address ICT acceptance challenges in Tanzania. This information is important since it points to areas which could be focused on by OS promoters.

4.5 Open source and ICT acceptance challenges

An OS approach is proposed as a teaching technique for ICT in colleges, schools and other training institutions (Zini and Lin 2006; Dionisio, Dickson, August, Dorin and Toal 2007). One OS project, called the Recourse project, is proof that OS principles and implementation techniques can be used as a framework for teaching computer programs (Dionisio et al. 2007).

Ellis, Morelli, Lanerolle, Damon and Rave (2007) also refer to the influence of OS on ICT education. The authors propose that OS could be used as a means of influencing computer science teaching in universities. Their research was driven by two research questions: they wanted to ascertain whether OS projects deliver the “real-world” experience computer science students need, and whether OS projects can help computer science educators attract large numbers of students, especially women. These researchers managed to show that through OS projects students do actually have hands-on experience in serious ongoing projects that could prove to be very effective. Furthermore, through online forums, portals and social communities, OS manages to promote ICT awareness among students.

The issue of real-world experience is also raised by Pedroni, Bay, Oriol and Pedroni (2007), who claim that one of the major problems of programming courses at universities is the lack of such experience among learners. Pedroni et al. (2007) argue that the existing OS projects are a perfect platform for students on which to practise and acquire skills that will make them ready for the ICT industry.

4.5.1 Open source and ICT skills

One of the major obstacles to ICT growth in developing countries is the lack of sufficient skills in designing and programming software (ECA 2000). Some authors have seen the introduction of OS as an opportunity to deal with this situation (Hansen et al. 2001). If the OS movement is well supported and promoted across developing countries, the end result would be an increase in design and programming skills for novices and inexperienced programmers (Hansen et al. 2001).

In researching the behaviour of code contribution to OS projects by the developers, Oreg and Nov (2007) conclude that self-development is one of the major factors that lead various developers to add free code to an ongoing project. OS projects are generally peer reviewed by experienced project stakeholders. These people offer feedback on the contribution made by developers on the projects. The feedback varies from code design principles to approach. Receiving feedback on the projects, and the best practices to tackle problems, shapes and increases the skills of those contributing to the development. According to Scacchi (2007), OS developers can exercise their skills and compete with each other in a way that is not possible in their current corporate jobs. Acquiring skills is also accompanied by a fun part in that developers strive to be regarded as computer geeks, which adds to their reputation. Participation in OS projects enhances programmers' performance and brings about innovation (Magnusson and Dahlander 2008; Bonaccorsi and Rossi 2006).

The issue of insufficient ICT staff has also featured in the literature as a challenge to ICT acceptance in Africa and developing countries in general. The observations in this section are indicative of the fact that OS can support the delivery of more ICT experts to make more people conversant with ICT, particularly when governments participate and reinforce ICT acceptance.

4.5.2 Open source and private sector support

One of the barriers to the growth of IT communities in developing countries is the fact that there are very few private organisations that provide ICT solutions. The burden is therefore carried mainly by government. In terms of the dominant proprietary software (Chonia 2003), very few private companies have emerged owing to the high cost of establishing ICT in developing countries. The literature reveals that OS can play a positive role in uplifting and encouraging the penetration of ICT in the private sector. Tirole and Lerner (2001) carried out research on the OS movement to explore the reasons why private companies should participate in the OS movement. The results included the following:

- Private companies, such as software vendors, would get extra money from complementary services.

- Allowing their employees to engage in OS would give private companies a great advantage in terms of knowing about the movement and placing themselves in a position to compete. Through participation, the companies would be in a position to spot highly skilled programmers and offer them employment. The companies would also be able to incorporate OS principles into commercial proprietary software and improve the end product.

The availability of OS developers and the presence of freely available OS software could entice the private sector to develop more technology on OS platforms. This implies that the popularity and growth of OS would be proportional to the growth of local private ICT companies taking advantage of the benefits of cheaper available technology (Mannaert and Ven Kris 2007).

The following popular IT organisations that have either strongly supported the OS movement or have shifted all their business to OS platforms (O'Grady, Governor and Cote 2007).

- IBM has realised revenue growth as a result of the reduction in development costs made possible by its engagement in OS platforms.
- Sun Microsystems has opted to use OS technology hoping that one day its entire software portfolio will be OS.
- The rise of the Linux operating system forced the decision to shift Open Solaris (an operating system) to OS.

Other large ICT organisations supporting the OS movement for their own benefit include Hewlett-Packard, Intel and Oracle (Karels 2003).

4.5.3 Open source, government commitment and language

According to the ECA (2000), the lack of government commitment to enforce ICT policies and regulations is an obstacle to ICT growth within a nation. As for OS, government engagement in OS movements reduces system acquirement costs, as well as enhancing security issues (Hansen et al. 2001). Specifically, government engagement leads to the growth of OS software productivity within a country. In a developing country like South

Africa, OS is an opportunity for the economic development of small business enterprises, since it allows the customisation of existing OS software by local companies (Van Belle and Ellis 2009). In supporting the OS movement and realising its potential, some developing countries such as South Africa and Iceland have managed to establish government policies that help to promote OS software (Bierman and Mtsweni 2008). The governments particularly play a management role within the movement; however, the implementation should be done by the software developers. Splitting the two would give the government the ability to monitor and control the projects. At the same time, the government would be free to involve as many companies as it chooses provided an analysis is done to determine who would do a better job in implementing the software (Thorbergsson et al. 2007).

Issues like culture and language need to be taken into consideration when creating a system for the user. The OS movement therefore provides a better opportunity for government involvement in that, since the source code is accessible, by monitoring and controlling the developer the government can facilitate the tailoring process and make the system fit its needs (Thorbergsson and Valfells 2007).

OS technology has also addressed some language issues whereby some software has been customised and its content translated into a local language. An example of such a software translation includes the translation of Mozilla, KDE and open office software into three South African local languages, namely Xhosa, Zulu and Venda. Similarly, the Google search engine has been translated from English into the South African languages, Xhosa and Zulu, as well as Swahili, a language used in East African countries (Chonia 2003). On the dealing with red tape issues by some governments, Chonia (2003) states that one advantage of OS for government would be that it helps to reduce bureaucratic red tape.

4.5.4 Open source and cost

The cost-effective characteristic of OS is among the most visible acceptance factors for deployment. When compared to its alternative, proprietary software, OS technology is believed to be less expensive (Bruggink 2003; O'Grady et al. 2007; The Dravis Group 2003).

IBM, one of the world's largest IT companies, has seen its revenue grow as a result of its decision to use OS for its product development (O'Grady et al. 2007). In acknowledging the cost-effective benefits of OS, Asiri (2003) states that, in Ottawa, NGOs and the university library have managed to reduce their annual expenses on running proprietary systems from \$8 000 to \$295 to \$400 by running equivalent OS systems.

The same is noted by Zini and Lin (2006), who focus on OS in education, exploring the case study of a school that opted for OS in its effort to reduce costs. In the year 1999, the school was given a budget of €18 075 with which to buy proprietary Microsoft Windows Office for a laboratory. Using their experience of OS, the school chose to install an equivalent OS system and ended up spending only €6 710. The remaining budget was used for computer equipment (Asiri 2003).

Care should be taken when one stating that OS software comes free of cost. While it is true that the licence fee for OS is minimal (Satchell and Peeling 2001), this does not mean that OS comes totally cost-free. If user skills are very poor, then training and support costs may even exceed the licensing fee (Lin 2007). Therefore, deployment of OS should be based on user skills and not acquisition costs only.

4.6 Summary

In this chapter technology acceptance models were linked to ICT acceptance challenges in Tanzania, as identified by the literature analysis. In particular, it is evident that ICT acceptance challenges in Tanzania are not that different from ICT acceptance challenges in other parts of the world, which form the basis for the technology acceptance models reviewed. Moreover, the ICT acceptance challenges and relevant technology acceptance models have also been linked to the characteristics of OS. This supports the notion that promoting OS acceptance could provide a strategy for addressing ICT acceptance challenges. In the next chapter, the data collection context is presented.

CHAPTER FIVE: DATA CAPTURING CONTEXT

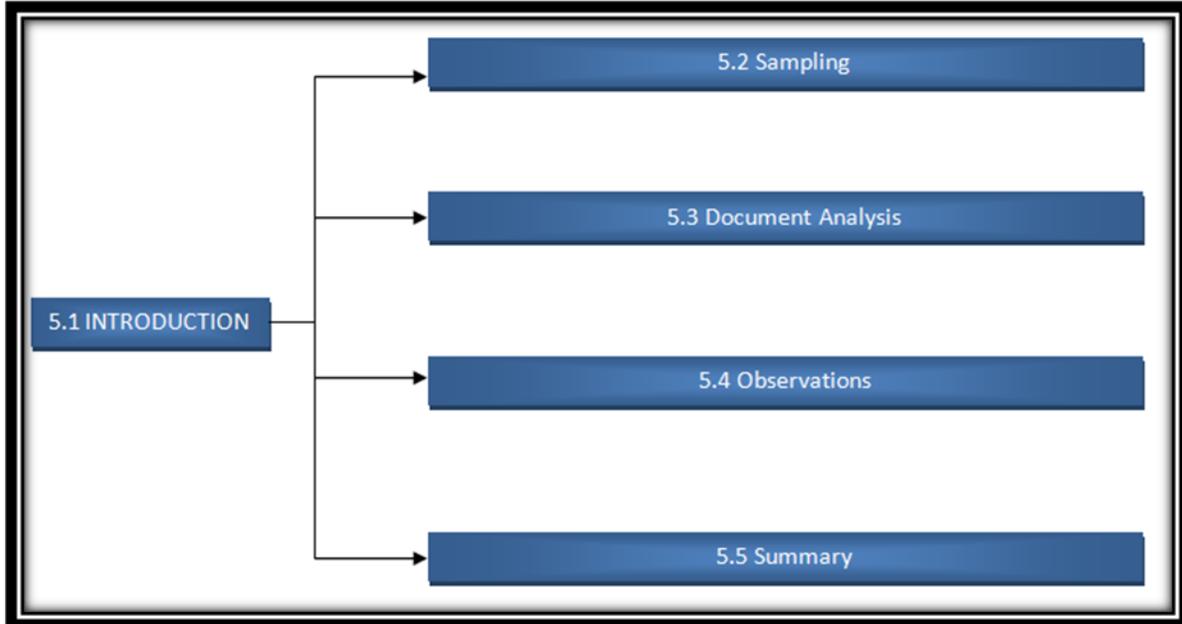


Figure 5.1: Discussion flow for Chapter 5

5.1 Introduction

This chapter explains the nature of the data that was collected, the reasons for collecting it and the way in which the investigation tools were used. In particular, details are provided on the way each of the research questions was answered using these tools. Data was captured using a literature analysis (as explained in Chapter 4), a document analysis, interviews, a survey and observations, as discussed in Chapter 3. Table 5.1 shows the objectives, research activities and tools used.

As stated in section 3.5 of chapter 3, the research strategy employed for this study is a combination of interpretive and mixed method research that uses case study and qualitative means of research methodologies. Upon conducting and evaluating interpretive field studies, Klein and Myers (1999) proposed a set of seven principles used in evaluating interpretive field studies namely, *the fundamental principle of the hermeneutic circle, the principle of contextualization, the principle of interaction between the researchers and subjects, the principle of dialogical reasoning, the principle of abstraction and generalization, the principle of multiple interpretations and the principle of suspicion.* In this study, each of the

seven principles is outlined below on how it was applied during data collection and analysis purposes

The seven principles are referred to as the principles of Hermeneutic Circle by which hermeneutic is regarded as the study of interpretation. The most fundamental principle that forms the basis of the other six is called the *fundamental principle* of the hermeneutic circle. This forms the idea that evaluation is done through interpretive iterations across different interdependent meaning of parts and the whole that they form (Klein and Myers 1999). In this study, each individual OS community explored is regarded as a sub-part of the collective communities put together. Exploration of promotion activities by iterating from one community to another is done so as to understand in general the activities done in the country. The fundamental principle of hermeneutic circle was also used to understand the communication tools used by the different OS communities in Tanzania. The communication tools range from chat rooms, discussion forums, email groups and internet blogs. The posted messages during discussions are explored as interdependent parts so as to understand the system of message posting as a whole, whether done via forums, emails, chat rooms or blogs

The principle of *contextualization* requires the researcher to reflect on the social and historical background of the research setting. In the study, this principle was applied in understanding the reasons that lead to ICT acceptance challenges in Tanzania as well as the reason that lead to the formation of OS communities in Tanzania.

The principle of *interaction* between the researchers and subjects, demands a reflection on how the data was obtained through the interaction between the researcher and the participants. In the study, the participants were mainly active OS community member. Few OS non-members that work in the industry level were also approached for interview purposes. Using the principle, data was collected through observation methods by which the researcher first interacted with the participant via email, blogs, chat rooms and discussion forum as an existing member of the four communities. Observation methods were then later used as guidelines in formulating questions that were conducted via interviews and questionnaires.

The principle of *dialogical reasoning* explores contradiction between the researcher's preconception of guiding research design and the actual findings. In the study the literature review provided in general the promotion activities conducted by various OS communities

globally. These in turn formulated the researcher’s preconceptions on OS promotions activities in general. The preconceptions created a comparison between OS activities done specifically in Tanzania and those conducted by other communities across the world. The application of this principle therefore helped the identification of OS promotions that are uniquely identified in Tanzania.

The principle of *abstraction and generalization* was applied in the study to explore the user acceptance behavior of ICT in Tanzania. Data interpretation was done in relation to the various ICT acceptance theoretical models (TAM, UTAUT, ASA and FIT) that were explored in the literature survey in chapter two. The listed ICT acceptance challenges in Tanzania were thus mapped with the various determinants of ICT acceptance deduced from the theoretical models.

The other two principles are the principle of *multiple interpretations* and the principle of *suspicion*. The principle of multiple interpretations explores different interpretations amongst participants. This was applied while conducting interviews where the researcher could get in details different opinions with regards to questions that related to ICT acceptance challenges and OS promotion activities in Tanzania. These questions were raised to both active OS members and non-OS members that are employed in the industry level. Both the two sides provided similar answers to some questions but greatly differed on others, specifically on the applicability of OS at the industry level. With the regard to the same scenario, the principle of suspicion was applied to address the bias on OS active members with regard to the success of OS and OS activities in the country. Hence the principle of suspicion lead to the participation of working class non-OS members in the interview process.

| Table 5.1: objectives, research activities and tools | | |
|---|---|---|
| Research objective | Research activities | Questionnaire and interview item |
| To identify ICT acceptance challenges in Tanzania | Literature analysis, interviews, survey | Questions 6 of the questionnaire and question 8 in the interview schedule |
| To identify | Literature analysis, document analysis, | Questions 8–13 of the questionnaire, questions 7– |

| | | |
|--|---------------------------------------|--|
| promotional activities | observation, survey | 11 of the interview schedule |
| To evaluate the effect of OS promotion | Interviews and survey (questionnaire) | Question 14–32 of the questionnaire and 7–8 of the interview |

5.2 Sampling

In total, 40 respondents were involved in this research. The demographic characteristics of the respondents, namely, gender and age, are presented in Tables 5.2 and 5.3 respectively.

| Facility | Male | Percentage | Female | Percentage |
|--------------|-----------|------------|----------|------------|
| TAFOSSA | 9 | 22.5 | 2 | 5 |
| TLUG | 8 | 20 | 1 | 2.5 |
| Kilinux | 9 | 22.5 | 2 | 5 |
| UBUNTU | 8 | 20 | 1 | 2.5 |
| Total | 34 | 85 | 6 | 15 |

As Table 5.2 depicts, there is an imbalance between men and women in terms of the extent of their participation in the four communities involved in this study. For example, of the 40 respondents involved in the research, only six women participated, giving a ratio of less than 6 to 1. This implies that those who did not participate in the research either did not use ICT actively or that women are generally less involved in the use of ICT. There is evidence to show that women constitute more than half of the Tanzanian population (URT 2003). This being the case, it could be argued that ICT and related activities constitute one of the areas in which women can be said to be participating less actively. Table 5.3 gives a representation of the respondents by age.

| Table 5.3: Respondents by age | | |
|--------------------------------------|--------------------|-------------------|
| Age range | Respondents | Percentage |
| 20–30 | 2 | 5 |
| 30–40 | 6 | 15 |
| 40–50 | 26 | 65 |
| Above 50 | 6 | 15 |
| Total | 40 | 100 |

Table 5.3 shows that most respondents cluster in the 40 to 50-year age group. This group could still be considered to be part of the economically active population of the country and, therefore, could also be said to be the major clients as far as ICT is concerned. It was also established that many of the respondents were in one way or another involved in ICT-related activities. For instance, 25 respondents, that is, 62.5%, were ICT professionals and included systems analysts, business development managers and consultants who had been in their fields of specialisation for more than 15 years. Another five respondents were purely end-users and comprised mainly university lecturers. The absence of participants from other sectors is indicative of the fact that the public may either be ignorant of the existence of OS facilities or that most of their activities are not ICT related. This suggests that attempts to address ICT acceptance challenges should go hand in hand with an attempt to cultivate an awareness of ICT needs.

It would seem that the majority of the population below 30 years comprises the student population, as many in this age group are studying at various academic institutions including universities. Most of this age group is then expected to be actively involved in national economic growth in the near future. Consequently, they are also expected to be well equipped with ICT skills and, therefore, there is a need for them to be aware of ICT acceptance challenges and the strategies that are in place to address them.

We now turn to the tools that were employed in the data collection in respect of research questions and objectives, starting with the execution of the questionnaire and survey.

5.2.1. Sampling of participants and execution of the survey

A survey questionnaire was distributed to a total of 30 respondents in order to elicit their views on and experiences of ICT acceptance challenges in general and OS activities in Tanzania in particular. The respondents who were involved in the survey differed from those to whom the interviews were administered. The respondents were principally persons who actively used OS facilities in Tanzania through the four OS communities, namely TAFOSSA, TLUG, Kilinux and the Tanzania Ubuntu Association. Table 5.4 gives a summary of the contribution of each community to the survey sample in relation to the number of active members.

Table 5.4: Survey respondents by open source facility

| Facility | Members | Respondents | % of study sample | Survey respondents | % of members sampled |
|-----------------|----------------|--------------------|--------------------------|---------------------------|-----------------------------|
| TAFOSSA | 28 | 11 | 27.5 | 8 | 72 |
| TLUG | 23 | 9 | 22.5 | 7 | 78 |
| Kilinux | 30 | 11 | 27.5 | 8 | 72 |
| Ubuntu | 21 | 9 | 22.5 | 7 | 78 |
| Total | 102 | 40 | 100 | 30 | |

On the survey questionnaire, the respondents were required to provide answers that would expand knowledge in relation to the three research questions. In terms of the first research questions, respondents were required to state the ICT acceptance challenges they had experienced (question 6). By means of the survey, the following ICT acceptance challenges were identified:

- Limited coverage
- Cost
- Language
- Lack of government involvement and support

- Policy
- Lack of awareness or knowledge
- Limited user-friendliness

For the second research question, the respondents had to demonstrate awareness of OS promotional activities based on their experience (questions 8–13 in the questionnaire). In terms of this question, the respondents demonstrated awareness of the following:

- Formation of OS communities
- Online forums
- Seminars and workshops
- Academic instruction
- Free software distribution
- Government and private sector participation
- Policy advocacy

With regard to the third research question, the respondents had to demonstrate an understanding of OS as reflected in their knowledge of the existence of OS, willingness to use OS, advantages of using OS at the expense of proprietary software and the potential for OS to be applicable in different domains of use (questions 7a). In response to research question number three, the respondents demonstrated that OS was

- affordable
- accessible
- collaborative
- modifiable
- transferable
- instantaneous

Questions 14 to 31 of the survey were then used to evaluate the OS promotional activities carried out by members of the OS community.

In the section that follows the interviews and the resultant data are explained in relation to the research questions.

5.2.2 Sampling of participants in the interviews

The interviews were based on the questions in the questionnaire. The researcher could clarify and modify the questions to suit the demands of the research but could also learn more from the interviewees as compared to the responses received from the questionnaire. The aim of the interviews was to obtain input from inactive but knowledgeable people on the issue of ICT acceptance challenges, as well as to evaluate the impact of OS promotional activities in Tanzania. The interview process involved the selection of 10 people who used ICT and dealt with ICT matters in the workforce and at the industry level. The individuals approached, therefore, included ICT end-users and ICT managers, who were required to provide their views on OS in relation to its characteristics and the ongoing promotional efforts currently in place. The findings obtained from the interviews were triangulated with the findings of the survey, and used to extend and explain the survey findings, as the interviews allowed for more in-depth data capturing. Table 5.5 shows the contribution of each of the OS communities to the interview.

Table 5.5: Interview respondents by open source facility

| Facility | Members | Respondents | % of the sample | Members interviewed | % of facility sample |
|-----------------|----------------|--------------------|------------------------|----------------------------|-----------------------------|
| TAFOSSA | 28 | 11 | 27.5 | 3 | 28 |
| TLUG | 23 | 9 | 22.5 | 2 | 22 |
| Kilinux | 30 | 11 | 27.5 | 3 | 28 |
| Ubuntu | 21 | 9 | 22.5 | 2 | 22 |
| Total | 102 | 40 | 100 | 10 | 100 |

Since the interview questions were similar to those contained in the questionnaire, the results of the interview did not differ significantly with regard to the three research questions. The only significant difference was that those interviewed could give more detail in their responses and could also give different views on the nature of the promotional activities. In the next section we explain the document analysis that was conducted for this research.

5.3 Document analysis

As already discussed, four OS communities, namely TAFOSSA, TLUG, Kilinux and the Tanzania Ubuntu Association were used as case studies. Accordingly, the document analysis was aimed at establishing the nature of the OS communities' activities in relation to OS promotion. Each individual OS community is now examined beginning with TAFOSSA.

5.3.1 Case study 1: Tanzania Free and Open Source Software Association (TAFOSSA)



Figure 5.2: TAFOSSA emblem

TAFOSSA is the abbreviation for the Tanzania Free and Open Source Software Association. This organisation aims at creating awareness about the OS movement in the country. According to the Association's 2006 constitution, the organisation aims to create awareness, build local capacity and coordinate the development of free and OS software, while ensuring integrity and conformity to the wider national ICT agenda. Specifically, TAFOSSA's activities include offering leadership in such areas as

- promoting free open source software (FOSS) for affordable access, choice and empowerment
- building local ICT skills, capacity and content through the use of FOSS
- quantifying and enhancing the economic benefits offered by FOSS
- developing and supporting the community of local FOSS users
- fostering the development of a Tanzanian FOSS community.

5.3.2 Case study 2: Tanzania Linux User Group (TLUG)

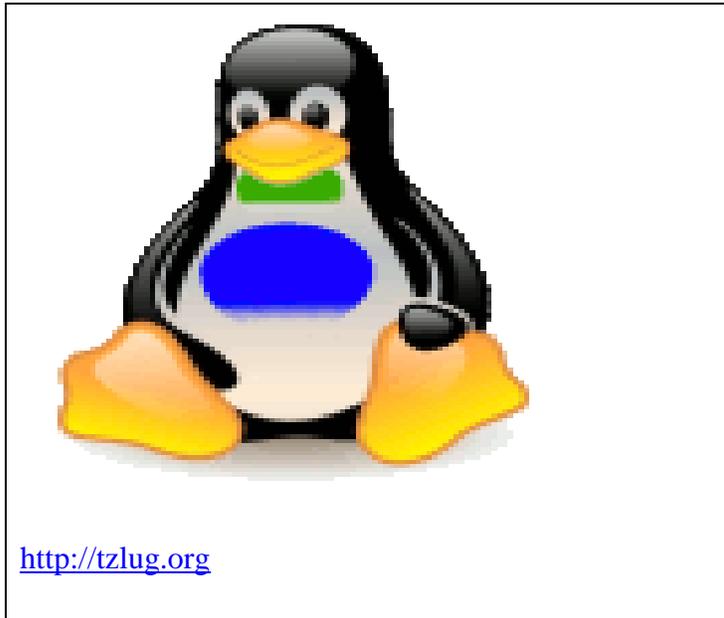


Figure 5.3: TLUG emblem

TLUG stands for the Tanzania Linux User Group. This OS community operates mainly as an online forum. An online forum is one of the key elements in the growth of an OS community (O'Reilly 1999; Rota and Osterloh 2007). Accordingly, through a forum, developers throughout the world share ideas and code, all in the development of a project. The main objective of TLUG is to provide a forum through which Tanzanians can meet and share their experiences in the development and use of OS tools and technologies. Generally, the main purpose is to make sure that OS is understood and used in Tanzania. The TLUG community's main activities include

- making Linux (a free operating system) distribution available
- providing online forums to promote discussions of OS-related matters
- organising courses, seminars and talks on OS-related matters
- organising and monitoring TLUG-related projects.

5.3.3 Case study 3: Kilinux



Figure 5.4: Kilinux emblem

Kilinux is an open Kiswahili localisation project. Kiswahili is the first Tanzanian official local language while English is the second. As noted in the literature review, language is one of the obstacles to the growth of local ICT skills in a developing economy because most ICT solutions are tailored to English, which may not necessarily favour the local people (Danowitz et al. 1995). With that in mind, Kilinux was established through efforts by the Department of Computer Science at the University of Dar-es-Salaam, in collaboration with the Institute of Kiswahili Research (IKR) and the College of Engineering and Technology (COET). The project has had some success in its efforts and measures have been taken to localise some technical terms related to ICT. The main activity of Kilinux is, therefore, to

- ensure that any technical knowledge available in foreign languages is made available in Kiswahili
- distribute OS software freely
- advocate for the use of OS.

5.3.4 Case study 4: Tanzania Ubuntu Association

The Tanzania Ubuntu Association is one of various free distributors of the Linux operating system across the world. The Tanzania Ubuntu Association team focuses on creating Ubuntu awareness in the country. Their main activities include

- acting as a point of contact between the Tanzanian Ubuntu users and the rest of the Ubuntu community
- providing help and support for Ubuntu users
- helping people get Ubuntu on CD/DVD easily by downloading and sharing with them
- spreading the word about and advocating the use of Ubuntu for individuals and organisations.

5.3.5. Case study results

The four OS communities have a common goal, namely to promote the use of OS in various areas of ICT application. For example, all four OS communities distribute free OS software as one of their strategies to make people interested in the use of OS as opposed to proprietary software, which is expensive; by doing so, they neutralise the issue of cost as one of the challenges to ICT acceptance in Tanzania. However, since ICT acceptance challenges are complex, the four OS communities address the challenges in many different ways and thus there are convergences and divergences in the focus of their activities. The following differences have been identified:

- TAFOSSA focuses mainly on creating OS awareness by coordinating various OS local initiatives.
- Kilinux strives mainly to localise foreign knowledge through OS; for example, by having the knowledge translated into a local language.
- Ubuntu aims mainly at forming a community of Ubuntu users and, accordingly, their scope is relatively limited in that very little consideration is given to the local situation.
- TLUG strives to create a large community of Linux users across the country.

As shown above, each of the OS facilities has active members that subscribe to and use the services. It is also apparent, however, that the communities differ in terms of representation in the sample, which may suggest that their facilities vary in terms of the effectiveness of their promotions. For example, Ubuntu had 21 members, thus resulting in a 22.5% response rate, which translates into relatively low coverage; while Kilinux, with 30 members, represents a 27.5% response rate, consequently having more coverage. In the next section, observation as a data collection strategy is explained in relation to OS promotional activities.

5.4 Observation

Participant observation was used to note the members' daily contributions via the online communication tools. The communication tools provided the space in which developers could meet and share code, as well as ideas on how to go about the projects. The researcher, therefore, observed the nature of the activities conducted online, including the frequency of topic postings, frequency of member replies, frequency of member code contributions and the number of new members joining. He was also able to determine member frustrations as the projects became complicated.

In particular, the researcher observed that

- all the communities had websites
- as with other popular OS communities, only one discussion forum is implemented for all the observed Tanzania communities
- discussions are mostly done via mailing lists using Yahoo and Google groups
- no implemented projects or ongoing projects were discussed – only initiated projects
- members were not frequent visitors or not very active
- some active members were Tanzanians dispersed overseas
- very few workshops were conducted – e.g TAFOSSA had conducted only one workshop in 2010
- online contribution is in terms of discussion and not project development
- members of the communities come from different educational fields (not just ICT)
- most of the communities had no specific hierarchy of leadership (it was difficult to determine the chairman, secretary etc).

Although claiming to have specific teams, no specific teams responsible for certain tasks could be identified.

5.5 Summary

In this chapter the data capturing context was described in more detail. The research questions were restated together with the research activities and the tools used to investigate them. The sampling for the survey and the interviews was described and the four OS communities were

presented based on the information gleaned from the document analysis. Finally, the method of observation and some of the data captured in the observations were presented.

The next chapter provides an analysis of the data and a discussion of the findings.

CHAPTER SIX: DATA ANALYSIS AND FINDINGS

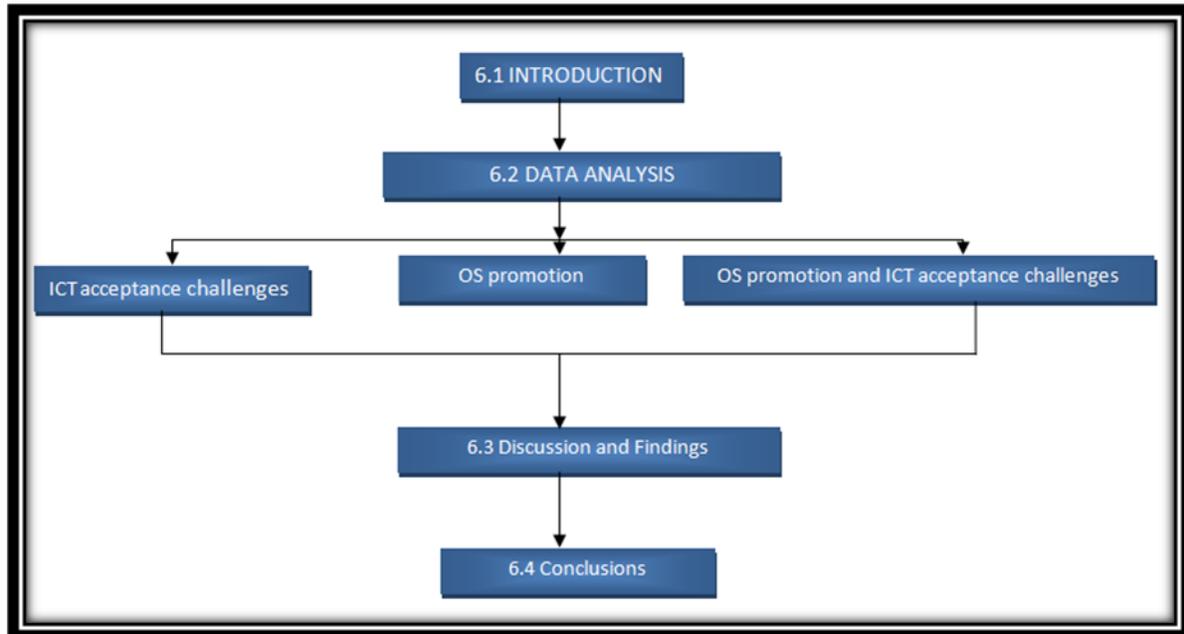


Figure 6.1: Discussion flow for Chapter 6

6.1 Introduction

This research formulated three objectives related to ICT acceptance challenges in Tanzania. The information for this research was obtained from the literature analysis (as discussed in Chapter 4), the document analysis, the 30 respondents who filled out the questionnaire, and the 10 participants in the interviews. The questionnaire is attached as Appendix 2. A spreadsheet outlining the pattern of questions in the questionnaire and the responses is attached as Appendix 4, while the interview questions are attached as Appendix 3. Table 6.1 maps the research objectives to the output via the research tools in order to demonstrate how the objectives were achieved.

Table 6.1: Mapping research objectives to research output

| Research objective | Research tools | Section where research output is explained |
|---|--|---|
| To identify ICT acceptance challenges in Tanzania | Literature analysis, surveys and interviews | List of ICT acceptance challenges in Tanzania that are moderators or determinants of ICT acceptance presented in the literature study (section 6.2.1) |
| To identify promotional activities | Surveys, interviews, document analysis and observation | List of promotional activities and advantages of OS in Tanzania (section 6.2.2) |
| To evaluate the effect of OS promotion | Surveys, interviews | Evaluation of promotional efforts currently undertaken by OS communities in Tanzania (section 6.2.3) |

The sections that follow are devoted to a discussion of the data analysis.

6.2 Data analysis

In the sections that follow the results of the surveys, interviews, document analysis and observations are presented in response to the research objectives. Each objective is dealt with separately, while the integration and implications of the outcomes of one objective in terms of the other are discussed. The discussion also establishes the link between the findings based on the literature analysis and the surveys, interviews, observation and document analysis. We now present the results based on each of the three objectives, as presented in section 1.8.2 of Chapter 1. Section 6.2 presents the findings on ICT acceptance challenges in Tanzania.

6.2.1 ICT acceptance challenges in Tanzania

The first objective, as stated in section 1.8.2 of Chapter 1, aimed to identify the various challenges that face ICT acceptance in Tanzania. Using a survey questionnaire (question 6 specifically), participants were asked to list the ICT acceptance challenges facing Tanzanian society. The results of the surveys were categorised and the number of times each category

was mentioned was tallied. Figure 6.2 depicts the major challenges identified based on the proportion obtained in the survey.

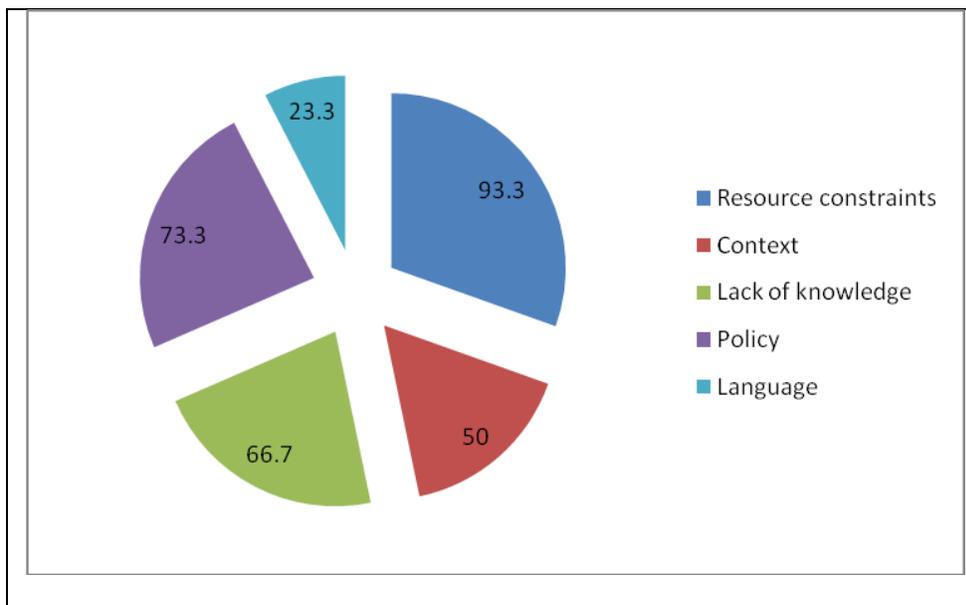


Figure 6.2: Major ICT acceptance challenges in Tanzania

It is evident from Figure 6.2 that resource constraints (mainly with regard to cost) are the most important ICT acceptance challenge, followed closely by the lack of policy implementation and the lack of knowledge and skills. The findings of the survey are also reflected in the literature analysis, where they are identified as low income and cost (see Table 4.1). The findings obtained from the interviews administered to 10 respondents in relation to the five ICT acceptance challenges that appear in Figure 6.2, are as listed in Table 6.2.

Table 6.2: Interview results on selected ICT acceptance challenges

| Challenge | Response | % |
|----------------------|----------|-----|
| Resource constraints | 8 | 80 |
| Context | 6 | 60 |
| Lack of knowledge | 10 | 100 |
| Policy | 7 | 70 |
| Language | 2 | 20 |

The results obtained from the interviews do not concur exactly with the results obtained from the surveys, in that not all of the ICT acceptance challenges retain their order in terms of frequency of occurrence across the respondents. Comparing the results obtained from the interviews with the results of the survey, it is observed that the same themes arise but the order of importance seems to differ. For example, *resource constraints*, which are the most important determinants of ICT acceptance challenges according to the survey results, appear to be the second most important challenge in the interview results.

The interviewees considered lack of knowledge as the most important ICT acceptance challenge in Tanzania. This difference in opinion may have been motivated by the fact that most of those involved in the interviews were professionals in different fields, including ICT, and therefore for them education on the use of ICT was a more important constraint than resource constraints. The issue of language retains its position as being least important in both the survey and the interviews. This confirms that language is not a particularly significant determinant of ICT acceptance challenges in the Tanzanian context. Each of the challenges identified will now be discussed in more detail:

- ***Resource constraints***

Based on the first objective, which sought to identify ICT acceptance challenges in Tanzania, as captured by the survey (item 6 of the questionnaire and reflected in the literature analysis), it was found that 93.3% of the respondents pointed to resource constraints as one of the *major challenges* facing ICT acceptance in Tanzania. This was also indicated by 80% of the interview participants. It was claimed that ICT infrastructure is capital intensive as it requires money to establish and maintain. Owing to this capital intensity, only individuals with sufficient income can afford such facilities. The issue of resource limitation is implicit in the responses from actual and potential ICT users whereby 95% of those who had already accepted ICT said that cost was one of the factors that resulted in some people not using ICT. Furthermore, 100% of those who had not accepted ICT were of the view that they would accept any ICT software, if the cost were relatively lower.

In line with resource constraints, it is understood that the majority of the Tanzanian population, especially in the rural areas, is poor and can barely afford basic necessities,

such as food, clothing and modest housing (URT 2003). One of the respondents commented that *“if someone cannot meet his basic needs, it becomes difficult for him/her to even think of ICT, but if cost was avoided, people would wish to accept ICT”*.

The findings suggest that, in general, the limited resources available for ICT activities are reflected in the restricted extent to which technology is put to use, the small number of ICT training centres and the limited number of ICT experts. It was also shown that the limited investment in ICT is a result of the lack of a consumer market; that is, since only a few people can afford the technology, only few people can afford to invest in the infrastructure.

- ***Context***

Another determinant of ICT acceptance challenges, as captured by the survey and the interviews and as reflected in Figure 6.2 and Table 6.2, was context. The respondents (50% of the survey sample and 60% of the interviewees) indicated that the prevailing local conditions in Tanzania are among the factors that constitute problems in terms of ICT acceptance and development. As far as context is concerned, it was indicated that the local environment economically, socially and culturally does not favour the intensive application of ICT.

The issue of context is also implicit in the literature analysis, as indicated by such variables as culture, illiteracy and poor infrastructure (see Table 4.1). The major point raised was that the population is still too involved in work that is physical labour intensive so that the demand for sophisticated tools, including ICT, is still minimal. Seven interviewees, that is, 17.5% of the total sample, were of the view that few Tanzanians engage in activities that demand the adoption of ICT and that the local initiative to be creative in product development has been suppressed by the ready availability of products from overseas and neighbouring countries. However, ignorance and lack of knowledge also limit the acceptance of ICT.

In general, it is evident that most Tanzanians have not been motivated to change their ways of doing things and this has had a negative influence on ICT acceptance. For example, eight interviewees (equivalent to 80% of interviewees) contended that there are people whose jobs could be greatly simplified by ICT but because they are comfortable with the

old ways they have not changed. Such people would need a very strategic promotion to prove to them that, without much effort, ICT could work even better.

In addition to the limited motivation, the majority of the rural population of Tanzania is either illiterate or limited to Kiswahili literacy. With regard to illiteracy, one respondent stated that ICT demands some reading ability in order for the user to follow some instructions, even if there is an instructor. This is because at some point one would need to communicate and respond to commands using the language peculiar to the ICT profession. Even for those who are literate in Kiswahili, two of the respondents thought that there is still very little software available in Kiswahili, and this may discourage people from trying to acquire ICT skills because of the possible embarrassment they could face in the attempt to acquire such skills.

Using an open-ended questionnaire, some 13 survey respondents, that is, 32.5% of the total sample, argued that, as ICT professionals and dealers learn that the grassroots, who could comprise the major consumers, is not a very reliable audience, because of the nature of their activities and linguistic limitations, they also limit their popularisation efforts. It was indicated that it regarded as unrewarding to attempt to reach the rural population, because there are no signs that even those who were willing would be able to accept ICT since it has limited use. Equally true was the observation that there is limited infrastructure, in particular electricity, without which ICT skills cannot be put to use even if such skills were to spread.

- ***Lack of knowledge***

In addition to resource constraints and context, the respondents identified a lack of knowledge about the existence and convenience of ICT as one of the determinants of ICT acceptance challenges in Tanzania. Lack of knowledge was also identified in the literature analysis as realised by a *lack of education, ICT awareness* and *poor information* (see Table 4.1).

The surveys showed that a lack of knowledge was regarded as third in importance after resource constraints and policy, which were first and second respectively, as reflected in Figure 6.2. However, in the interviews *lack of knowledge* was the most significant ICT acceptance challenge, as it was named by all interviewees (100%), as reflected in Table 6.2.

It was noted that ICT could still face acceptance challenges even if other factors are addressed, because if people do not know about the different uses of ICT, they probably would not adopt ICT even if resources were not scarce and ICT was affordable, or the context negative. This is evidenced by the findings, as 11 (27.5%) survey respondents indicated that some ICT software is not user-friendly. Indeed, it would seem that the question of user-friendliness is a matter of preference, based on attitudes and prior knowledge of ICT software.

The lesson that can be learnt from the observations in this section is that education is needed so that both the actual and potential ICT users can rid themselves of erroneous attitudes with regard to ICT applications in some domains of use. In the context of the current investigation, this calls for effective education. Some 15 survey respondents (37.5%) were of the view that certain aspects of ICT were not particularly popular, as many people were not aware of their existence.

- ***Policy***

Most of the respondents demonstrated an awareness that the growth and acceptance of ICT in Tanzania depends to a great extent on the degree to which policy makers will recognise the importance of ICT in promoting a knowledge-based society. This is reflected in the fact that the element of policy came second in the survey (73.3%) and third in the interviews, as shown in Figure 6.2 and Table 6.2 respectively, as well as in the literature analysis as realised by *policy issues* (see Table 4.1). Moreover, 80% of the respondents in the interview showed that Tanzania has not realised the importance of giving a boost to ICT for the general betterment of society, despite having in place an ICT policy. Affirming this claim, one ICT company manager pointed out that Tanzania had not given tax incentives to ICT-based firms. The respondent added that since the country has not paid due attention to the area of ICT, it is lagging behind in the field of spreading education using the latest technology. Respondents suggested that it was not enough to have policies in place; the implementation of policies deserves increased attention.

Demonstrating an understanding of the influence of policy on ICT acceptance, 50% of the interviewees maintained that people in general and Tanzanians in particular tend to have more trust in issues that are overtly and practically supported by the government. They further argue that issues which are undertaken solely by individuals and private operators tend to be

questionable since there have been instances where businesses have been abused by private practitioners and consequently banned by government. Thus, government could help to spread the word since its voice is more trusted and it also has more resources.

Another way in which policy influences ICT acceptance, according to one of the interviewees, is that the government is responsible for the daily operation of all activities such that legal and institutional support could be easily realised. Citing an example, the respondent said that the government could demand that every government employee be ICT literate.

- ***Language***

As per Figure 6.2, 23.3% of the survey respondents claimed that policy could also influence the issue of language, as it may foster the use of the language with which people are familiar. They added that there have been instances where such a move has worked, including the bilingual use of Kiswahili (the national language) and English in various areas which had been dominated by English only. Examples include filling forms used in the banking industry, as well as transactions at automated teller machines (ATMs). They added that the same could be done in other areas of ICT, including computer programs. In the literature analysis it was established that language is one of the major factors that hinder the easy assimilation of ICTs by many developing countries (Keats 2003; Keats et al. 2004; Vakentesh and Massingue 2003). Furthermore, radio and TV programmes, computer software and printed texts are produced in different countries with different cultural backgrounds. Consequently, such tools may fail to impress users in another country, hence affecting ICT acceptance negatively.

Summary

With respect to the first research question, which aimed at identifying ICT acceptance challenges in Tanzania, it was found that the tools of investigation used, including the literature analysis, produced very similar findings, both explicitly and implicitly. That is to say, both theory and practice agree in respect of the ICT acceptance challenges in Tanzania. Furthermore, the determinants of ICT acceptance in Tanzania that have been mentioned are relatively similar to the ones noted in some other developing countries worldwide and in Africa in particular.

The major contribution of this section then has been to disclose the ICT acceptance challenges in Tanzania that remain unaddressed so that the available means of addressing the situation

can then be evaluated on the basis of these findings. Section 6.2.2 examines the promotion of OS in Tanzania, from which we can gauge the promotional efforts in relation to the established ICT acceptance challenges.

6.2.2 Promotion of open source

The second objective in this study as captured in section 1.8.2 in Chapter 1 was to establish what had been done in Tanzania to promote OS as a strategy to limit the ICT acceptance challenges identified. The assumption was that the ICT challenges identified need to be addressed and the evolution of OS communities was one of the possible means of doing so. However, OS has not been widely established in the country, since the use of proprietary software monopolises ICT-related issues. It was, thus, necessary to promote OS in order to create public awareness and demonstrate how OS can provide ways of addressing existing ICT acceptance challenges.

Three data collection instruments, namely a survey, interviews and observation, as explained in Chapter 3, were used. The results obtained by means of all three instruments showed that OS communities in the country had put in place a number of activities, all meant to make the public aware of the existence and workability of OS. Some OS promotional activities were identified from documents prepared by the OS communities, showing strategic plans in which activities were described. However, in order to note the implantation of OS community plans in practice, the OS documents were also analysed. The researcher also actively participated in online discussions from which he could see what had been planned and implemented. The survey (questions 8–13) required respondents to rate the strategies in relation to their contribution in addressing the promotion of OS in Tanzania. The findings indicate that a number of strategies are used in the promotion of OS in Tanzania – see Table 6.3.

Table 6.3 Distribution of OS promotional efforts based on surveys

| Strategy | Measure/percentage | | | | |
|----------------|---------------------|-------------|-----------------------------------|-----------|----------------|
| | Totally unimportant | Unimportant | Neither important nor unimportant | Important | Very important |
| OS communities | 0 | 0 | 0 | 17.5 | 82.5 |

| | | | | | |
|---------------------------------------|---|---|---|------|------|
| Online forums | 0 | 0 | 0 | 20 | 80 |
| Free software | 0 | 0 | 0 | 26.5 | 73.5 |
| Seminars | 0 | 0 | 0 | 26.5 | 73.5 |
| Campaigning OS policies | 0 | 0 | 0 | 15 | 85 |
| Academic education on OS applications | 0 | 0 | 0 | 50 | 50 |

Apart from the survey, the researcher also probed 10 interviewees on the same issue, that is, OS promotional activities and their importance in addressing ICT acceptance challenges. The findings are presented in Table 6.4.

Table 6.4 Distribution of open source promotional efforts based on interviews

| Strategy | Measure/percentage | | | | |
|---------------------------------------|---------------------|-------------|-----------------------------------|-----------|----------------|
| | Totally unimportant | Unimportant | Neither important nor unimportant | Important | Very important |
| OS communities | 0 | 0 | 0 | 20 | 80 |
| Online forums | 0 | 0 | 0 | 30 | 70 |
| Free software | 0 | 0 | 0 | 40 | 60 |
| Seminars | 0 | 0 | 0 | 0 | 100 |
| Campaigning OS policies | 0 | 0 | 0 | 20 | 80 |
| Academic education on OS applications | 0 | 0 | 0 | 20 | 80 |

The survey and interview results show that all the strategies involved in OS promotion (as indicated in Tables 6.3 and 6.4) were rated as either *important* or *very important*. That is to say, all the strategies were deemed to be *important*.

When the survey results are compared to the results obtained from the interviews, there do not seem to be any significant differences. For example, seminars and workshops are considered to be *very important* by all (100%) the interviewees and 73.5% of survey respondents. The main view that emerged from the interviewees was that some people in the workforce are not aware of the existence of OS or its ability to handle issues which have been traditionally entrusted to proprietary software, adding that the only feasible way in which to address this is to bring OS to the attention of the wider public.

The interviewees also indicated that education will not only inform the public of the existence and use of OS, but will also address other positive attributes of OS such as affordability, transferability and so on. Similarly, both the interview and the survey results suggest differing views among respondents regarding the importance of distributing free software. In particular, interviewees attached less importance to the free distribution of software than survey respondents, 73.5% of whom thought that the free distribution was *very important* compared to 60% of interviewees.

The main argument raised by the interviewees was that it was not enough to distribute free software if people do not know what to do with the software or how to use it. Survey respondents also seemed to differ in terms of the role academic education plays in OS applications. The survey shows that the respondents were equally divided between those who indicated this as *important* and those who said it was *very important* (50%/50%). This differs from the interviewees' views, 80% of whom find academic education *very important*. The main argument raised by the interviewees is that academic institutions are the most effective vehicle for knowledge spread and sustenance.

Despite the fact that there had been efforts to promote OS, some gaps in the promotional activities were noted. For instance, in the surveys and interviews (items 11 and 33), the respondents were required to point out weaknesses and gaps in OS promotion in terms of uncovered areas and the implementation of the planned programmes. The common issues which featured in the surveys and interviews pertained to the following:

- Limited number of discussions in the forums
- Members are not frequent visitors nor are they very active
- Limited number of workshops

Policy and regulatory issues featured in the interview only, where six interviewees (60%) maintained that there were problems regarding policy and the regulation of OS promotion and the general use of ICT. Specifically, there was poor policy reinforcement and guidance pertaining to the use of OS in marginalised sectors such as agriculture and small business. Moreover, through participation in and observation of the activities of the OS communities researcher noted that

- most of the communities have no specific hierarchy of leadership
- there were no specific teams responsible for certain tasks
- the only discussion pertained to initiated projects
- some members did not reside in Tanzania.

Summary

With respect to OS promotional activities, we have found that OS promotion has been mainly undertaken by OS communities in Tanzania, as represented by the four OS communities that form the case studies for this research. In particular, the OS communities have instituted a number of activities, including, among others, free software distribution, online forums, dissemination seminars and workshops, academic instruction and policy advocacy.

In spite of these promotional activities, there are still gaps particularly with regard to the intensity of the activities as compared to what is potentially stipulated in the OS communities' plans, as there have been limited online discussion forums and seminars and workshops. This suggests that even if OS promotions have been successful to an extent, still more could be achieved if plans and activities were to be executed as required. Section 6.2.3 examines the success that OS promotion has achieved in respect of ICT acceptance challenges in Tanzania.

6.2.3 The success of open source promotion in addressing ICT acceptance challenges

The third objective of the study, as captured in Chapter 1 (section 1.8.2), was to assess the extent to which OS promotion has had an impact on the ground. This was done by examining

what the respondents knew about OS and what they do with OS, as well as the way in which they compare OS and proprietary software in relation to ICT acceptance challenges in Tanzania. Information was captured using interviews (items 8 and 7) and the survey questionnaire (questions 14–32). These questions in the questionnaire sought to ascertain how the respondents perceived OS in terms of the features associated with it. Figure 6.3 shows the positive features of OS as reflected in the views of the respondents to the survey based on their experiences with OS (question 7a).

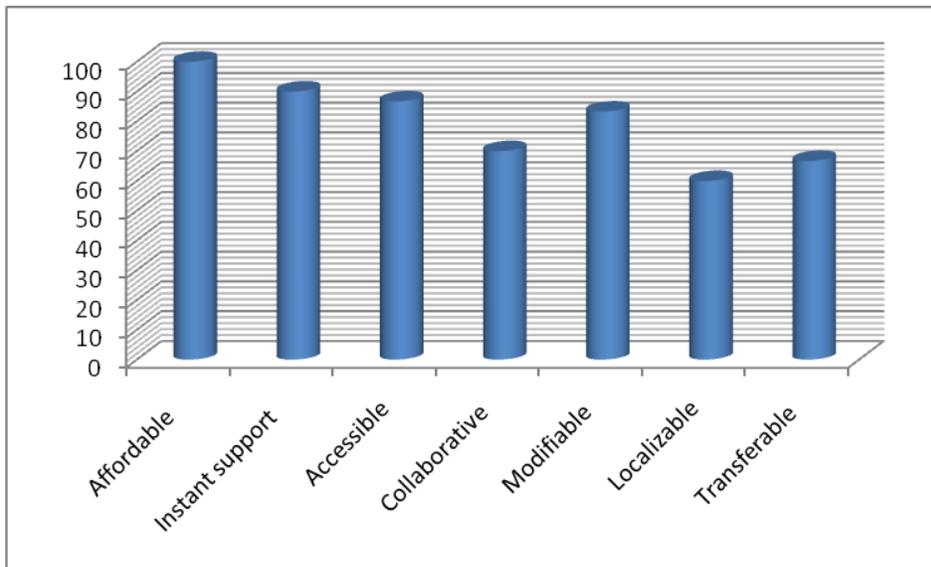


Figure 6.3: Perceived positive features of open source by percentage as per survey

In addition to the findings from the survey depicted in Figure 6.3, data was also captured from the interviews (items 7 and 8) to establish what the respondents take to be the positive attributes of OS. The results are as shown in Figure 6.4.

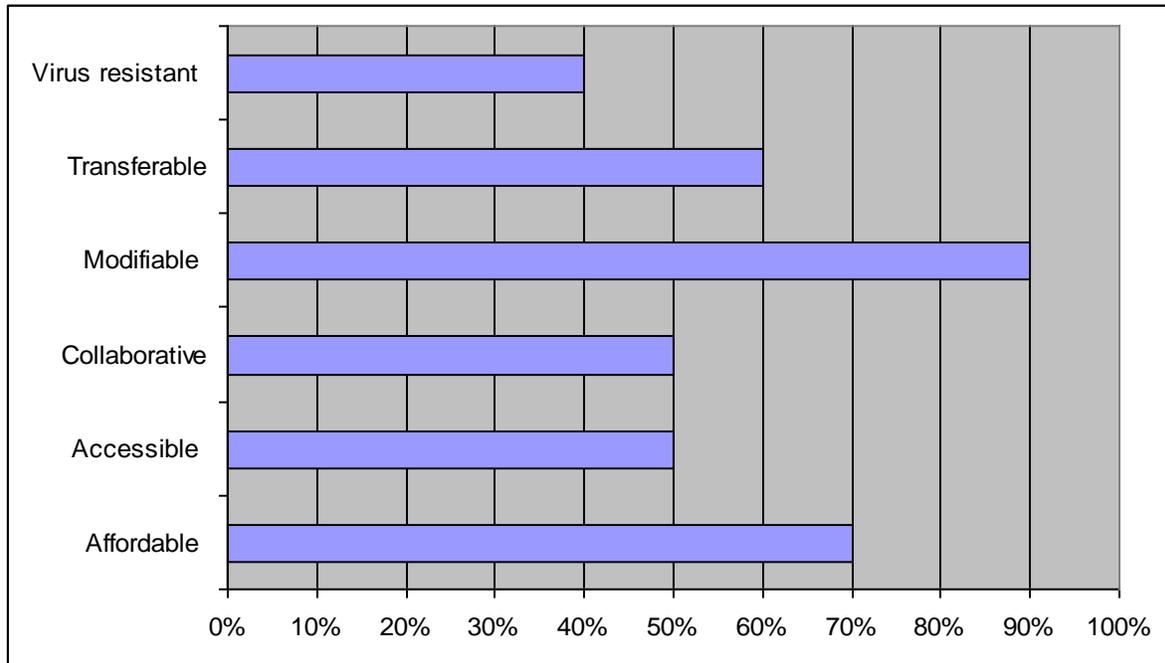


Figure 6.4: Perceived positive features of open source by percentage as per interviewees (Source: Field data)

Based on the findings of the survey and the interviews, it would seem that respondents are aware of some of the features of OS, which shows that the respondents used OS, although in varying degrees.

One of the significant differences between the survey and the interview results is that some features identified by the survey results are missing from the interview results. Specifically, whereas virus resistance featured in the interviews, respondents to the survey did not indicate it. In addition, the aspect of localisability, which appears in the survey, seems to have been implied by modifiability in the interview. Indeed, if something is modifiable it also means that it can be localised. The goals and methods of surveys and interviews are too different to be able to compare the data obtained from each directly, but it is interesting to observe that, while 90% of survey respondents regarded the most salient feature of OS as affordability, modifiability was perceived to be more significant by 90% of the interviewees. Again this inclination could be attributed to the fact that those interviewed had more technical experience, as they were professionals who had participated in different ICT-related projects, while many of those involved in the survey had only participated in OS online communication and, hence, cost was an important factor as well.

Further results based on the survey are hereby presented by focusing on selected items. In Table 6.5 questions on skills and the responses to them are as presented in Figures 6.5a and 6.5b.

Table 6.5: Skills (items 18–20 of the questionnaire)

| |
|---|
| 18. How would you rate the average IT skills of each member per community? |
| 19. What is the level of online project contribution of the members in the online community public discussions? |
| 20. What type of IT skills do you think are mostly addressed under various topics posted by members on open source community online forums? Please prioritize by placing a number on an empty line: 1 being the highest value and 5 the lowest. |

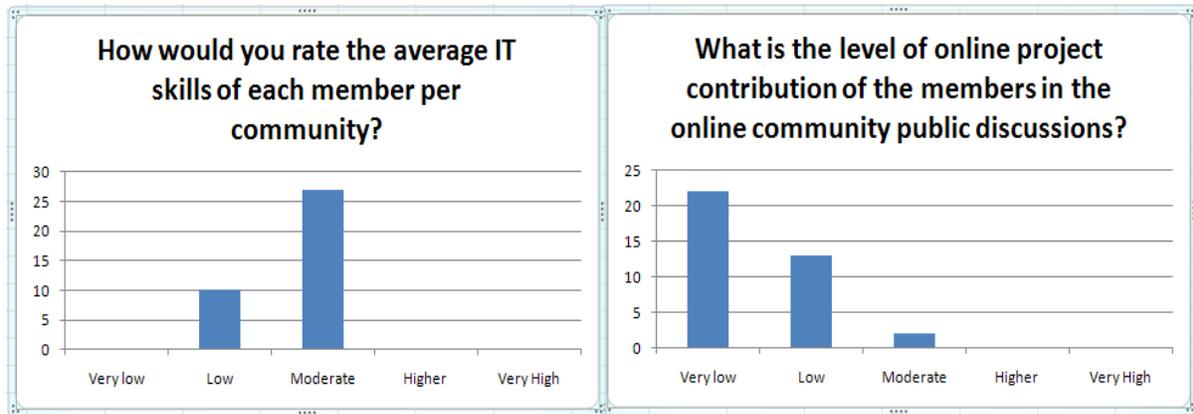


Fig 6.5a: Graphical presentation of skills level category/online contributions

As per Figure 6.5a, 27 of the 30 respondents involved in the surveys maintained that OS community members had moderate IT skills, while another 10 indicated that the members had low skills levels. Likewise, the contribution of online projects is not as effective as laid down in the strategic plans. Hence, 22 respondents regarded it as very low, 13 as low and only three as moderate. Figure 6.5b shows the types of skill that are most addressed in online discussion forums; accordingly, computer troubleshooting leads with the highest rate, followed by basic IT knowledge, data handling and computer programming. The skills were rated on a scale of 1 to 5, whereby the highest value (5) represents the highest rate and the lowest value (1) represents the lowest rate.

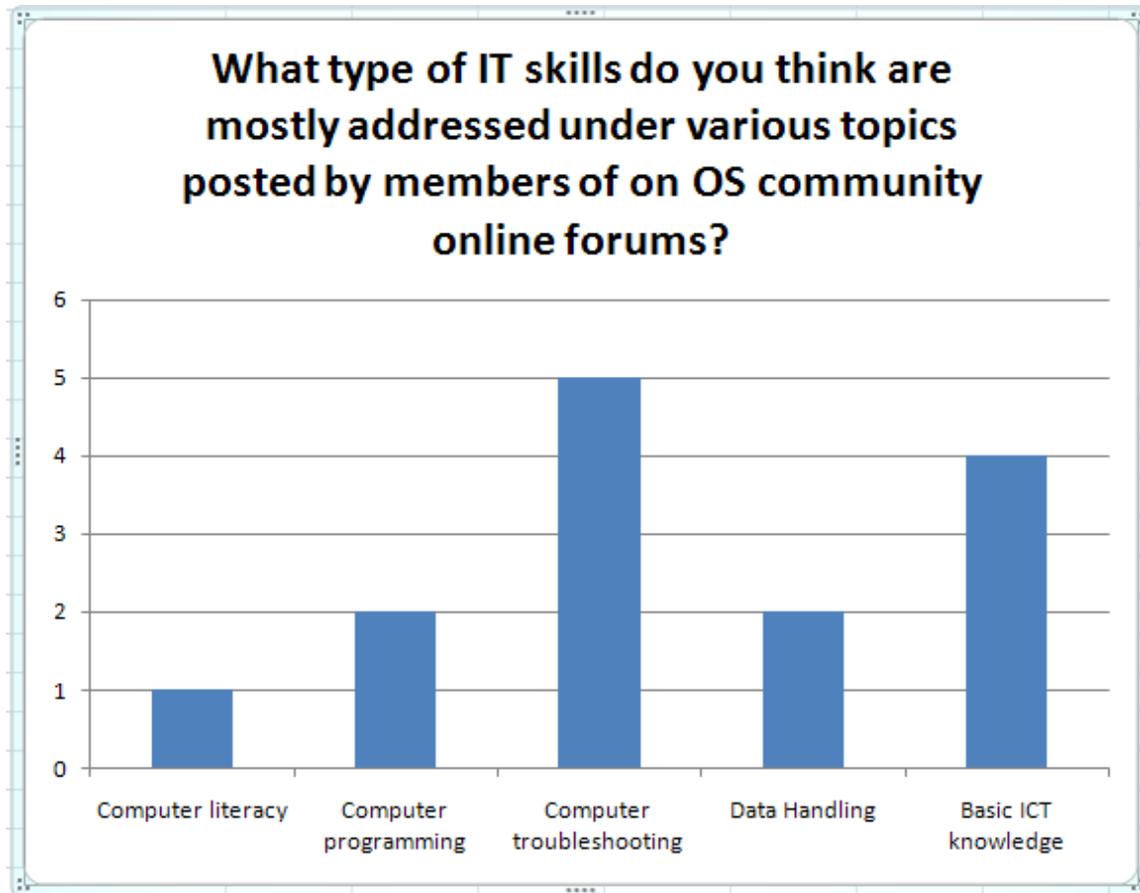


Fig 6.5b: ICT skills mostly addressed in online forums

Based on Figures 6.5a and 6.5b it could be seen that not enough has been done in terms of skills acquisition, as responses to this question were *moderate*, *low* or *very low* (Fig. 6.5a), while the most addressed skills (Fig. 6.5b) seem to be relatively complex for beginners. For instance, computer literacy has the lowest score, although it is most important for beginners.

To evaluate OS promotion in addressing Tanzanian ICT acceptance challenges, as established from the literature, the survey questionnaire was divided into four categories, namely vendor dependency, OS awareness, cost, and government and private sector support. Each category is a determinant of ICT acceptance, and OS promotional efforts in Tanzania are evaluated on the basis of this questionnaire.

6.2.3.1 Vendor dependency

This inclusion of this category was to determine whether an organisation can rely on an existing OS community to offer ICT solutions. An organisation would require that proper support be

available from the vendor should the need arise. The results from the survey questions on vendor dependency are listed in Table 6.6.

Table 6.6: Vendor dependency (items 14–17 of the questionnaire)

| |
|--|
| 14. Are you a member of an existing open source community in Tanzania? |
| 15. How many open source communities in Tanzania are you aware of? |
| 16. How many active members are there on average in each community? |
| 17. Can an organisation rely on IT solutions that might be offered by the open source community? |

The survey depicts the availability of OS communities. Question 14 was intended to confirm that the participants were indeed members of an OS community. Most of the respondents claimed that the number of existing OS communities did not exceed 10. The average number of active members per community also lies between 10 and 20. Only six respondents claimed an average of more than 20 members per community. The results obtained to the last question in Table 6.6 are graphically presented in Figure 6.6.



Fig 6.6: Open source reliability

As shown in Figure 6.6, most OS community members believe in the reliability of the ICT solutions offered by the OS community, as indicated by the fact that 26 agreed and five strongly agreed that organisations can rely on the ICT support provided by the OS communities.

6.2.3.2 Open source awareness

This category was an attempt to determine the level of success the OS communities had attained in raising awareness of the potential of OS. Awareness-raising is done by conducting seminars and workshops that would eventually provide training to end users. There is also a strategy in terms of which privately owned IT companies become partners in efforts to advocate OS-related advantages. The questions pertaining to this category are listed in Table 6.7 and the answers on the number of events conducted annually are given in Figure 6.7.

Table 6.7: Open source awareness (items 21–23 of questionnaire)

- | |
|---|
| <p>21. How many other external partners does the open source community you belong to have?</p> <p>22. How many events (seminars, workshops or meetings) have your open source community conducted annually?</p> <p>23. How would you rate the level of success of conducted seminars to the public?</p> |
|---|

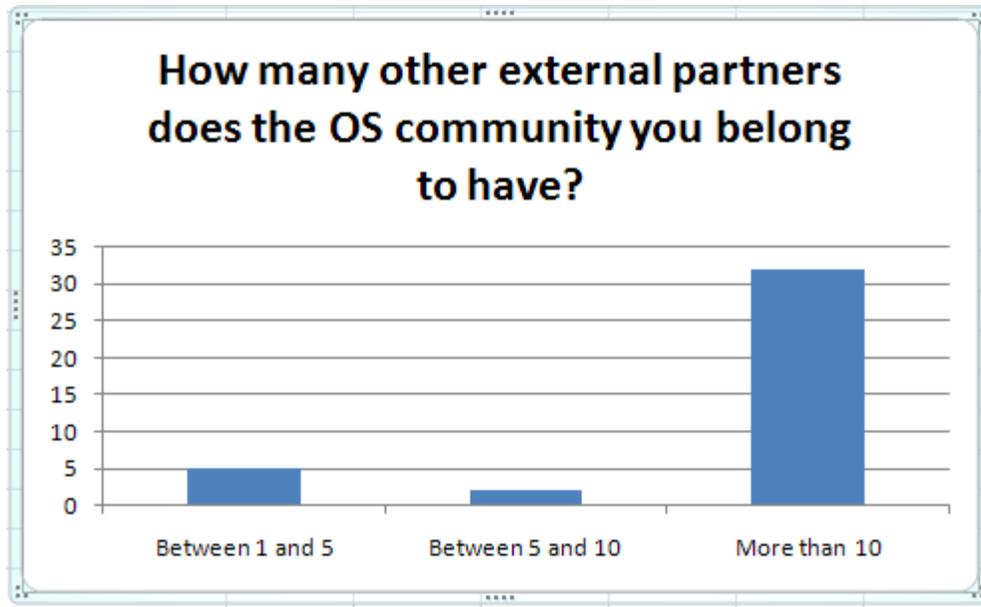


Figure 6.7: Extent of external partnership

The question on the number of partners was included in order to ascertain whether OS community members were aware of relationships with external partners, including other OS communities. Subsequently, the survey responses show that members seemed to have varied knowledge but most respondents indicated that they had partnered with more than 10 other practitioners (see Fig. 6.7).

As regards the number of events, such as seminars, workshops and meetings, that OS communities had conducted, it was found that the OS communities had conducted between one and five events, which suggest that events had not been fully used as a promotional tool. With respect to the effectiveness of the events, more than 20 survey respondents judged the success of the seminars as low, three as very low, 13 as moderate and two as high. In general, therefore, success could be said to be not very impressive (see Fig. 6.8).

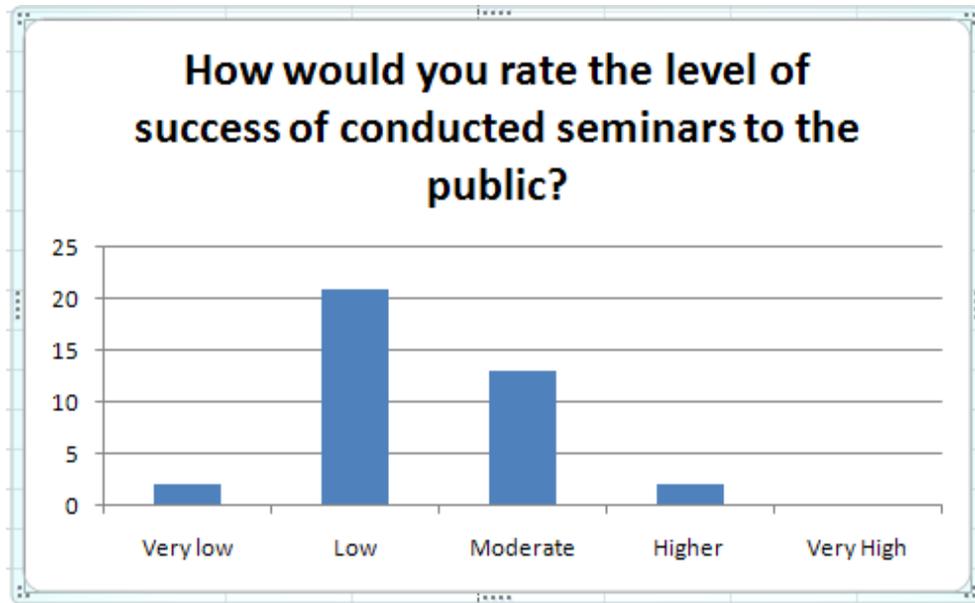


Figure 6.8: Success of seminars and workshops

6.2.3.3 Cost

Given the importance of cost (listed under resource constraints), we take a closer look at its importance in OS promotion. The literature analysis reveals that low income and cost related to ICT establishment is one of the factors that influence ICT acceptance. A survey was used in an attempt to determine the level to which OS can address the cost that accompanies ICT products. The responses are structured according to the following issues.

- *Product purchase cost.* The results show that OS software carries no purchasing costs as the product/software is available and distributed freely on the web.
- *Product licensing cost.* The results show that the licensing terms are in line with the OS licence agreement: that is, the product is free for the duration of its use and development.

The responses to the product maintenance and training costs are depicted in Figure 6.9 and the responses to the product distribution cost in Figure 6.10.

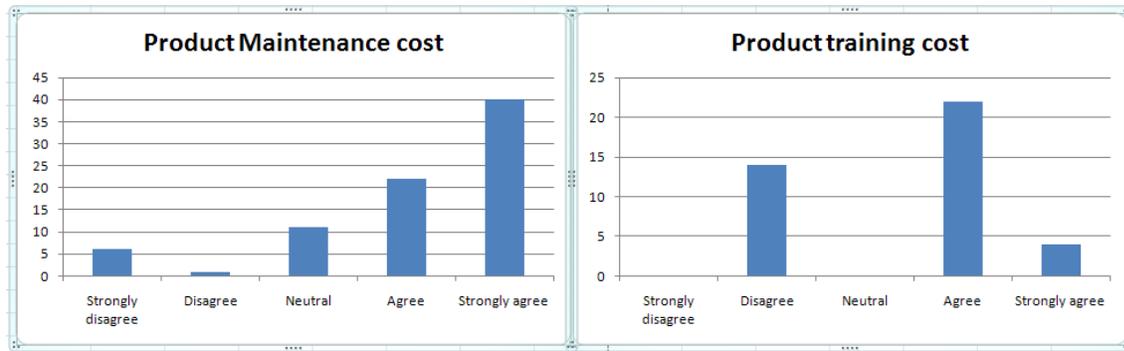


Fig 6.9: Open source addressing product maintenance and training cost

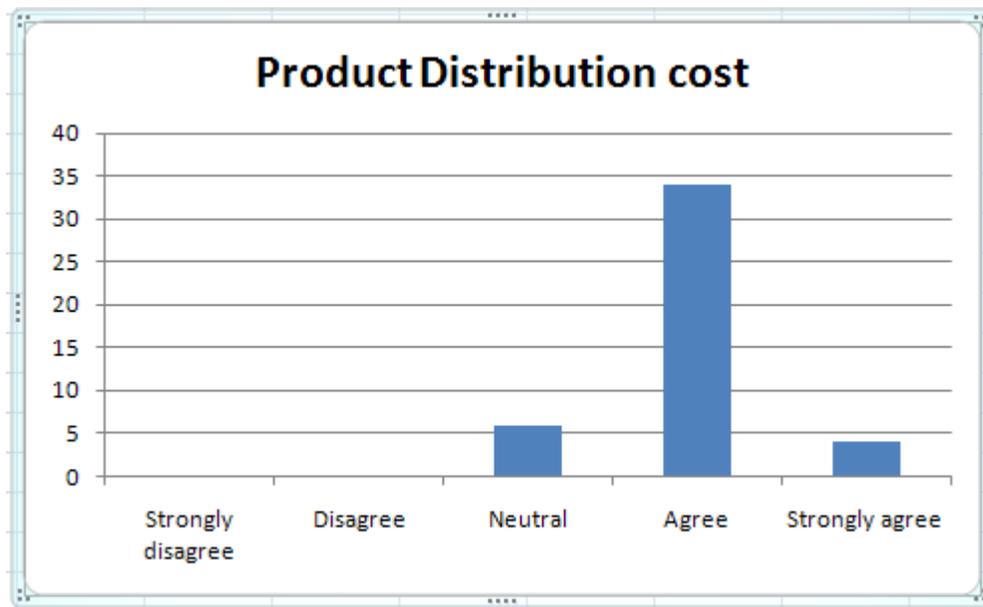


Fig 6.10: Open source addressing product distribution cost

The results indicate that most participants perceive that OS addresses ICT costs, including product purchase costs, product licensing costs, product maintenance costs, product distribution costs and product training costs. However, five respondents strongly disagreed on the issue of maintenance costs, as they felt that OS involves significant maintenance costs.

6.2.3.4 Government and private sector support

The literature reveals that the government plays an important role in the growth of ICT in the country (Mushi 2007). The government and private organisations are regarded as the biggest consumers of ICT products. The survey (items 29–32) investigated the level of support provided by the government and the private sector to the OS communities. The findings show that no more than five government institutions partnered with the OS community in (question

30), while more than ten private institutions partnered with the OS community in such movements (question 29) (see Fig. 6.11). The results also indicate very limited support provided by the government as indicated by 30 respondents in question 31, while private sector support would seem to be promising, as 30 respondents indicated substantial support from the private sector (question 32).

Table 6.8: Government and private sector support (items 29–32 of the questionnaire)

| |
|---|
| 29. How many private sector companies have partnered in your open source movements? |
| 30. How many government institutions have partnered with your community in its open source movements? |
| 31. What level of assistance is given by the government to the open source community? |
| 32. What level of assistance is provided by private institutions to the open source community? |

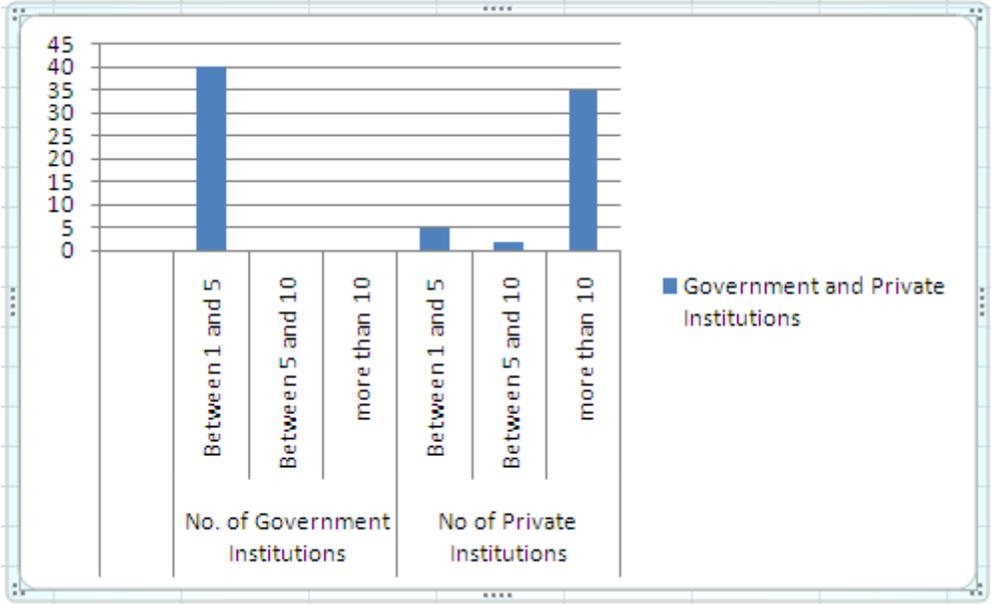


Figure 6.11: Graphical presentation of government and private sector category

Initially, it was established that both government and private actors are involved in the promotion of OS in the country. However, there were differences in the manner in which the two agencies impinged on promotion. The main activity of government was to formulate policies and regulations that could encourage favourable conditions for the growth, adoption and sustainability of OS.

One example of policy formation is the Tanzanian government ICT policy document of 2003, which recognises OS as an important vehicle for ICT penetration in the population. Despite this policy, the government has not explained the practical application of the policy through the establishment of institutions that could both inspire and promote the spread of ICT (Mushi 2007). That is to say, the government has remained mainly on the level of propaganda instead of mentoring promotion on the ground. Consequently, at the time of this research there was no single government producer or distributor of ICT software in general and OS in particular. As seen earlier in the literature, the ECA (2000) identifies a lack of government commitment to enforce ICT policies and regulations as an obstacle to ICT growth within a nation. On the other hand, Hansen et al. (2001) point to the importance of government involvement, claiming that government engagement in OS movements reduces system acquisition costs, as well as enhancing security issues. This means that if the government remains neutral with regard to OS production, circulation and promotion the industry will be adversely affected.

6.3 Discussion of the findings

In this section the findings pertaining to the three objectives presented in section 1.8.2 are discussed in relation to the results presented in section 6.2. Thus, section 6.3.1 presents a summary of the findings on ICT acceptance challenges in Tanzania, section 6.3.2 presents a summary of promotional activities and section 6.6.3 concludes with an assessment of OS promotional strategies in addressing ICT acceptance challenges.

6.3.1 ICT acceptance challenges in Tanzania

The results on ICT acceptance challenges in Tanzania are displayed in Figure 6.2 (for surveys) and Table 6.2 (for interviews). It was found that resource constraints were among the most significant determinants of ICT acceptance, as indicated by 93.3% of the respondents in the survey (Figure 6.2) and 80% of the interviewees (Table 6.2). Resource constraints have an

impact on the purchasing power of potential ICT users, this in turn brings a negative effect towards the actual usage of an ICT system. This therefore means that OS promotion could target the issue of resource constraints by showing that OS could reduce or do away with the costs associated with ICT by users of OS as opposed to the expense of proprietary software. However, there seemed to be a lack of knowledge on OS in general, which also means that the public is ignorant about the cost-effectiveness of OS.

Lack of knowledge was given more weight by 100% of the interviewees (Table 6.2), but it appears to be third in importance according to the survey results (Fig. 6.2). The issue of lack of knowledge needs to be attended to by OS promoters, since without knowledge the public may overlook information on features associated with OS which could attract more people to use it.

Further, the survey respondents appeared to understand that, in order for OS promotion to be effective and meaningful, policy could not be ignored. The issue of policy was noted by 73.3% of the respondents from the survey (see Figure 6.2) and 70% (Table 6.2) of the interviewees. These findings are indicative of the fact that ICT policy in favour of ICT in general and OS in particular needs to be put in place. The promotion of OS is examined in section 6.3.2.

6.3.2 Open source promotional activities

In general terms, the survey respondents tended to value the contribution of all the OS promotional activities that they appraised. Based on Tables 6.3 and 6.4, OS promotional activities were, in order of importance, regarded as *totally unimportant* and *very important* (see Tables 6.3 and 6.4). Accordingly, ICT policy was seen as the most important aspect of OS promotion; indicated as *very important* by 85% of the survey respondents (Table 6.3) and 80% of the interviewees (Table 6.4). This implies that the respondents could see that policy on ICT practices could be a significant factor in terms of motivating people to use OS and therefore enjoying the benefits associated with its use; consequently addressing ICT acceptance challenges.

As confirmed in the literature, policy advocacy is considered to be significant since this directly implicates the government as the main stakeholder in regulation, mentorship and promotion. However, some of the respondents still did not attach very much importance to policy advocacy. For example, 20% of the interviewees and 15% of the survey respondents (Tables

6.3 and 6.4 respectively) indicated that OS policy was simply *important*. Justifying their position, the interviewees claimed that policy formulation alone is not enough, as more practical things have to be done on the ground. It was learnt from the interviewees that the government of Tanzania has not been particularly active when it comes to actual facilitation, although the policy stipulations appear to be attractive and appealing. This observation has been consistently reported in the literature in most developing countries and Tanzania is no exception.

On the other hand, the survey respondents considered the formation of OS communities to be *very important* in the attempt to promote OS in Tanzania. This was supported by 82.5% of the respondents (see Table 6.3) and 80% of the interviewees (see Table 6.4). It should be recalled that the respondents sampled for this study were all contacted through the four OS communities involved in the study. Furthermore, some respondents were engaged in one way or another in ICT-related activities and technologies. Despite the benefits the respondents seem to have accrued from the OS communities they had joined and participated in, some 17.5% of the survey respondents (see Table 6.3) still did not give the OS community option full importance in addressing the ICT acceptance challenges, as they said the strategy was *important* rather than *very important*.

This situation also occurred in the interviews, where 20% of the interviewees indicated that formation of OS communities was simply *important* (see Table 6.4). This suggests that there are some conceived limitations and weaknesses as far as OS communities are concerned. According to the researcher's observations of OS communities, some weaknesses are demonstrated in terms of what is advocated by their constitutions and the strategies they present.

Another promotional strategy was the use of online forums where participants are given an opportunity to exchange views, ideas and experiences via the Internet. As indicated in Table 6.3, online forums were labelled as *very important* by 80% of the survey participants, while 70% of the interviewees thought that online forums were simply *important* (see Table 6.4).

Again it could be said that there were variations among participants in terms of the discussion topics carried out in the forums. Accordingly, there were some skills which were ignored in the discussion while others, especially advanced ones, were favoured. One explanation given by an

interviewee was the fact that most of the participants are individuals with good ICT skills and therefore most of the skills were on a sophisticated level so as to meet the active members' expectations. One of the interviewees claimed that the skewed distribution could also be attributed to the fact that the public had not been active enough and thus basic skills could be almost redundant owing to a lack of consumers and thus contributors. The strategy thus failed to accommodate the needs of a wider audience and this made the online audience almost static with no new members joining. As a consequence, the OS campaigns were really only for those who had already attained a certain level of ICT skills.

Seminars and workshops, as well as free software distribution, were rated by 73.5% of survey respondents (see Table 6.3) while 100% and 60% respectively of interviewees (see Table 6.4) as *very important* vehicles for OS promotion. Seminars and workshops seem to be particularly important in addressing the challenges of a lack of awareness and low income respectively. These two strategies are also complementary in that they tend to facilitate each other. For instance the distribution of free software makes no impact if the beneficiaries themselves cannot use it as a result of limited computer literacy. In such cases, seminars and workshops can help to mediate the situation and make it workable. Nevertheless, seminars and workshops will make little sense if they attempt to educate people on things that they cannot afford to buy. Accordingly, the public should have access to the software at little or no cost. The fact that a high proportion of participants labelled seminars and workshops as *important* rather than *very important*, could be taken as an indicator of some inherent gaps in the two strategies (seminars/workshops and software distribution). For example, what is covered in the training by means of workshops and seminars may fail to cater for every individual's needs or the needs of certain social groups and professions. Similarly, free distribution does not necessarily guarantee use and application of the software, but depends on the nature of the activities. Moreover, people will take anything if it is free even though they have nothing to use it on.

The last feature of OS promotion measured by the participants was promotion through academic instruction, which can be better achieved by addressing it in the school curriculum. According to the survey results, participants were equally divided between those who considered it *important* and those who thought it was *very important* (see Table 6.3). However, the situation was quite different in the interview, where academic education on OS application was considered *very important* by 80% of the respondents (see Table 6.4); with only 20% of the

respondents indicating that academic education was simply *important* (see Table 6.4). The interviewees who thought academic education was simply *important* claimed that there could be differences between what people know and what they actually practise. This is because the application of what we learn at school often only makes sense when we are exposed to appropriate situations. What this means is that the school curriculum may sometimes not reflect what actually takes place in society. One suggestion was that there was a need to create demand for OS in the social environment.

This subsection has essentially explored OS promotion in Tanzania as manifested in different activities aimed at making the public aware of the existence and workability of OS software in the country, as means to capture the conceived ICT acceptance challenges. Indeed, the established OS promotional activities are those which have already been put into practice, in the sense that they are strategically planned on the assumption that they would work at the expected levels. As the results show, however, different people rate the strategies differently based on their experiences of the prevailing local conditions, as well as the extent to which the programmes are actually executed. Section 6.3.3 examines the actual impact that OS promotion has had on ICT acceptance challenges in Tanzania.

6.3.3 The success of open source promotion in addressing ICT acceptance challenges

This section discusses the success that had been achieved through the promotion of OS in relation to ICT acceptance challenges (see objective 3 in section 1.8.2). Where OS has been promoted by OS communities, this section evaluates the success of that promotion in terms of what the respondents know and can do.

As stated in the literature, OS is one of the strategy that has been used worldwide to address ICT acceptance challenges. However, since local conditions differ across countries, OS as an intervention strategy may have varying success rates, depending on the degree of public awareness, among other variables. Moreover, OS practices take on different shapes which may affect their success in different communities.

Based on the information in Figure 6.3, more than 90% of the survey respondents identified affordability as one of the major features that differentiate OS from its proprietary counterpart. Similarly, affordability was mentioned by 70% of the interviewees (see Figure 6.4). These

findings suggest that the respondents were aware of the cost benefits that OS has over proprietary software. This knowledge was only possible if the respondents had had some experience with OS; hence, successes in this regard could be attributed to OS promotion through OS communities.

As was noted in the literature analysis and the findings in Chapter 4 and 5, resource constraints are among the most significant challenges facing ICT acceptance in developing countries in general and Tanzania in particular. It can then be concluded that the affordability of OS can address resource constraints as an ICT acceptance challenge. It can therefore be concluded that OS could provide some solutions to some of the issues pertaining to ICT acceptance challenges in Tanzania. As pointed out previously, income differentials among the population are reflected in the patterns of ICT acceptance in Tanzania, as well as in the developing world in general. However, the affordability of OS could make more sense if more efforts were made to see that the public is encouraged to make use of the facility. This means that people have to have a reason for using the software; in other words, a demand should be created.

Another feature that gives OS an opportunity to address ICT-related challenges is the fact that it is accessible in the sense that it is free of proprietary rights and procedures that might discourage users from using the facility. This fact was underlined by 82% of the survey respondents (see Figure 6.3) and 50% of the interviewees (see Figure 6.4). By making OS more easily accessible, more people will be encouraged to accept it, thus providing an alternative to the bureaucracy associated with proprietary software.

Sixty-eight percent of the survey respondents (see Figure 6.3) and 50% of the interviewees (see Figure 6.4) mentioned that OS is collaborative such that different people can share their knowledge and experiences and thus facilitate rapid adoption of ICT. One of the interviewees stated that when people learn that they can find answers to their problems from other people without paying them or even seeing them, they become motivated. Similarly, it was pointed out that the discussion topics posted on forums and blogs may make people aware of things that they did not know or they previously had not bothered find out about because they thought they would not benefit. In this way, therefore, people change their attitudes to certain applications. Another point raised in relation to collaboration is that people tend to imitate other people. For

instance, it was said that when people learn that certain programs and applications can be found in OS, there is the possibility that they will tell their friends, who will, in turn, adopt the source.

The respondents indicated that the ability of OS to be modified gives it an advantage over other sources since users can modify the facility to suit their needs. The interviewees indicated that different people have different ICT demands because of the varied nature of their activities. This would mean then that any system that may not allow modifications to suit different situations and applications may have disadvantages over a user-friendlier tool. The flexibility of OS in addressing individual differences among groups thus makes it preferable to proprietary software.

Another observation closely related to modification is the fact that OS can be transferred from one individual to another without linking the transaction to the manufacturer. This tends to reduce the bureaucracy involved in acquiring the facility and which is the case with conventional proprietary software. Transferability was mentioned by 63% of the respondents in the survey and 60% of the interviewees (see Fig. 6.3 and 6.4 respectively). The interviewees also linked transferability with affordability in that even those with low incomes could have access to the facility from friends and relatives without compromising the licence requirements.

Another feature of OS is the ability of OS to be adapted to address local conditions. About 60% of the survey respondents were aware that conditions are not uniform around the world (see Fig. 6.3). The same observation was implied by interviewees with respect to modifiability, in which case 90% of the interviewees said OS was modifiable (see Fig. 6.4). Indeed, if OS can be modified it means it can be used in a variety of local conditions. The major concern in relation to this localisation was the issue of language. The interviewees pointed out that language was an obstacle that could discourage people from adopting ICT since most of the programs, instructions and applications are available only in English. This is an important consideration since the majority of Tanzanians are fluent in Kiswahili and other local languages. At the same time these are the very people who are involved in the majority of production activities in the country. Kilinux was given as a good example of a source that has considered the question of localisation in an attempt to get more users to adopt ICT by offering alternatives to some operations and terms which people might find difficult. Although the respondents could not say exactly the extent to which Kilinux had succeeded in developing local terminology that could

cater for the dominantly Swahili-speaking population of Tanzania, the initiative indicates the good intentions of OS in terms of accommodating differences in local conditions across the world.

It can therefore be concluded that there is evidence that some efforts have been made to create public awareness of the existence and usability of OS. More importantly, there are also signs that OS promotion has had some multiplier effects, as five interview respondents were unaware of any promotion related to OS, even though they used the facility. This may indicate that the respondents had learnt about OS from other users and practitioners and the message could still be spreading. Despite the successes that can be directly attributed to OS promotion, it could still be argued that the sample involved in the study was too limited to certain professions that demand various forms of ICT; in other words, other professions like teaching, marketing, clearing and forwarding might not have been represented. Although this argument does not dispute the achievements of OS promotion, it should be regarded as having differential effects across people's participations and activities, which OS promotion should consider accommodating in future.

6.4 Conclusion

In this chapter the three objectives of the study (see section 1.8.2) formulated for answering the research questions were discussed. With respect to the first research question (see section 1.9), which sought to identify ICT acceptance challenges in Tanzania, it has been shown that Tanzania faces a number of ICT acceptance challenges, which range from the local environment, a lack of policy, language, cost, lack of knowledge and poor government and private sector support, as discussed in section 6.2.1 and summarised in section 6.3.1. Given the scope of these challenges, any attempt to deal with them should be multidisciplinary and comprehensive, and should take the local context into account in order to be effective.

The second research question sought to establish the nature of OS promotional activities. With regard to the attempt to address the ICT challenges through OS, it has been established that, in Tanzania, some effort has been made to arrest the challenge as is attested to by the presence of OS communities, whose main function is to use various promotional activities to create public awareness of the software. It has been established that the OS communities are engaged in promotional activities of various forms, such as conducting seminars and workshops, distributing

OS software, organising online discussions and the like, as discussed in section 6.2.2 and summarised in section 6.3.2.

The third research question was to assess the impact that OS promotion has had on the ground using the participants. It has been established that the respondents could talk about OS and compare its features to proprietary software and could also explain the importance of the different promotional activities. This means that there is an awareness of OS and OS promotional activities among the sample participants. However, several confounding factors and challenges were also identified, as discussed in section 6.2.3 and summarised in section 6.3.3. The following chapter, Chapter 7, will conclude the study.

CHAPTER SEVEN: CONCLUSION AND CONTRIBUTIONS

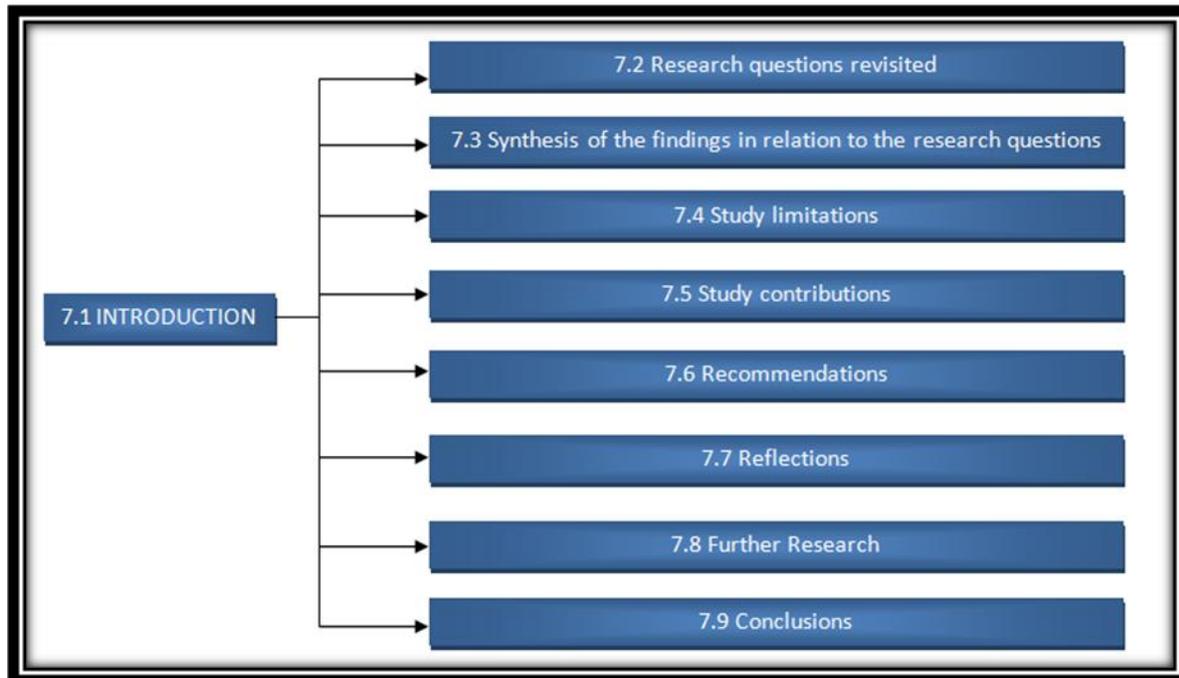


Figure 7.1: Discussion flow for Chapter 7

7.1 Introduction

This chapter concludes the research by revisiting the findings of the study and then discussing its limitations and contributions. In addition, the chapter contains a section on recommendations for changing OS promotional efforts in Tanzania. The chapter begins by briefly summarising the three objectives as stated in Chapter 1 section 1.8.2. The first objective was an attempt to identify ICT acceptance challenges in Tanzania; the second objective examined OS promotional activities in relation to the ICT acceptance challenges; and the third objective evaluated the OS promotional efforts in terms of addressing the ICT acceptance challenges identified. Section 7.2 now revisits these objectives by discussing the research questions and the findings relating to the questions. Section 7.3 presents a synthesis of the findings in relation to the research questions, section 7.4 discusses the limitations of the study and section 7.5 explicates the contributions. Section 7.6 presents the recommendations, section 7.7 presents a reflection by the researcher and section 7.8 discusses further research. The chapter concludes with section 7.9.

7.2 Research questions revisited

This study has answered three research questions as follows:

Question 1. What are the ICT acceptance challenges in Tanzania?

This question was answered using a literature analysis, which was presented in Chapter 4 (see Table 4.1), to identify the various ICT acceptance challenges in Tanzania. These challenges were further confirmed by the survey and the interviews, the results of which were presented in Chapter 5 (see sections 5.2 and 5.3 respectively).

The final set of challenges based on the literature analysis was identified as the following:

- donor dependency
- poor information
- illiteracy
- culture
- language
- lack of ICT awareness
- poor infrastructure
- cost
- low income
- training
- lack of education,
- lack of skills
- lack of ICT experts
- lack of private of sector participation
- lack of research institutions
- policy issues

In investigating these challenges in the context of Tanzania, the findings of the survey and the interviews produced the following main ICT challenges: resource constraints (including limited coverage and cost), context, policy (including lack of government involvement and support), and lack of knowledge (including ICT awareness and ICT knowledge).

Question 2. What is done to promote open source in Tanzania?

Information on the nature of the activities deployed to promote OS was first extracted from documents provided by the four OS communities, which explained their plans of actions and their activities. The OS promotional activities noted in the documents were then confirmed using the survey questionnaire (see section 5.2), interviews and observation (see section 5.3). The final list of OS promotional activities in Tanzania includes the following:

- formation of OS communities
- online forums
- seminars and workshops
- academic instruction
- free software distribution
- private sector participation
- policy advocacy

Question 3. How successful are the OS promotional activities in addressing the ICT acceptance challenges in Tanzania?

Data on the success of OS promotion in relation to ICT acceptance challenges was drawn particularly from information provided by end-user participants in the survey questionnaire and in the one-on-one interviews (see sections 5.2 and 5.3 respectively). Table 7.1 gives a summary of the research design.

Table 7.1: Summary of the research design

| Research question | Research activity | Output |
|---|---|--|
| What are the ICT acceptance challenges in Tanzania? | Literature analysis, survey, interviews | A list of the ICT acceptance challenges in Tanzania that are the moderators or determinants of ICT acceptance as presented in the literature study – see sections 6.2.1, 6.3.1, 7.2 and 7.3. |
| What is done to promote OS in Tanzania? | Literature study, document review, interview, survey via questionnaire, observation | List of promotional activities as well as the advantages of OS in Tanzania – see sections 6.2.2, 6.3.2, 7.2 and 7.3. |
| How successful is OS promotion in addressing ICT acceptance challenges in Tanzania? | Interviews, survey via questionnaire | Evaluation of promotional efforts currently undertaken by OS communities in Tanzania. Awareness of OS and rating of its advantageous features against the ICT acceptance challenges identified. Also includes a list of promotional activities that have either failed or succeeded in addressing ICT acceptance challenges – see sections 6.2.3, 6.3.3, 7.2 and 7.3. |

7.3 Synthesis of the findings in relation to the research questions

In this study, all three research questions were answered. In terms of the first question, which pertained to ICT acceptance challenges, the results obtained with the research tools used, namely, a literature analysis, a survey questionnaire and the interviews, indicated that ICT acceptance included cost, low income, lack of ICT awareness, poor information, illiteracy, lack of skills, lack of ICT experts and lack of education. Others challenges include poor infrastructure, culture, language, lack of training, donor dependency, lack of private sector participation, lack of research institutions and policy-related issues.

Indeed, it is clear that the information captured by the survey and that obtained in the interviews support each other, and that the same findings kept recurring across the different data collection methods. This triangulation supports the validity of the tools used, as well as the authenticity of the findings.

With regard to the second question, which examined OS promotion in Tanzania, it was found that a number of activities have been undertaken to address ICT acceptance challenges in Tanzania. These include the formation of OS communities, online forums, seminars and workshops, academic instruction and free software distribution. Others include private sector participation and policy advocacy. Since this OS promotion was coordinated by the four OS communities involved in the study, document analysis was an important starting point for data collection. The findings of the document analysis could then be confirmed by consulting end-users by means of a survey, interviews and observation in order to establish the actual implementation of the OS promotional activities. Although it was found that the OS promotional activities had been carried out as planned, the execution of the activities lacked intensity and conviction. For instance, seminars and workshops, as well as online discussion forums, were found to be limited both in terms of frequency and coverage. This is one area where concentration could be improved if ICT acceptance challenges are to be addressed through OS promotion.

The third question was on the success of OS promotional activities in addressing ICT acceptance challenges in Tanzania. Accordingly, the respondents were found to be aware of OS and its features, namely affordability, accessibility, collaborativeness, modifiability, transferability and immediacy. It was also noted that there had been increased use of OS in different domains, which meant that the word on OS was spreading. Despite the positive impact that OS promotion could have had, ICT acceptance challenges have not been successfully addressed given the weaknesses identified in the promotional activities and also the complexity of ICT acceptance identified by the first question.

7.4 Study limitations

The limitations of this study are mainly confined to the sampling. One of the limitations was that the sample was small, that is, 40 respondents as compared to the population that is potentially ICT literate in the country. Another limitation was that offline users were not involved in the study owing to the difficulty involved in locating them, given the time and resource constraints on the study. Finally, the government sector was not represented. Further investigation should include a larger sample with more participants in the different domains of use, which should also include the government. In some cases there were small differences between the groups, which,

because the sample was too small for inferential analysis, made it difficult to decide how significant the differences were.

7.5 Study contributions and contextualisation

This research contributes to the understanding of ICT acceptance challenges in Tanzania at a time when Tanzania and the world at large needs ICT given the globalising world community. However, understanding the ICT acceptance challenges is not enough; hence, the need to investigate the measures that are currently being taken to address the ICT acceptance challenges facing Tanzania. In this research, this has been done by focusing particularly on OS promotional activities in Tanzania. Accordingly, the identification of these promotional activities is the second contribution of this study.

As a third contribution, the OS promotional activities have been assessed to establish the extent to which they are geared towards addressing the ICT acceptance challenges identified.

These three contributions are thus interrelated such that without understanding the nature of ICT acceptance challenges, it is impossible to design remedial strategies; moreover, any remedial strategies should be weighed against the ICT acceptance challenges to determine any changes or modifications that should be made to the strategies.

Given the more comprehensive understanding of the ICT acceptance challenges in Tanzania as provided here, as well as the deficiencies in OS promotional activities, a more appropriate undertaking of OS promotional activities is possible. Finally, the three contributions made here can be related back to the technology acceptance model for OS presented in Figure 4.2. The findings support the relationships proposed between the components but more research on a larger sample is needed to verify the relationships between the determinants and moderators statistically.

7.6 Recommendations

On the basis of the discussion in Chapter 6 and the conclusions drawn in this chapter, the following recommendations are basically a reflection of what has transpired throughout the study.

The government, as one of the major stakeholders in ICT acceptance and OS in particular, has an important role to play. Firstly, it is the organ concerned with the formulation and reinforcement of policies and regulations guiding ICT in Tanzania. The government, therefore, stands a better chance of formulating, reinforcing and reviewing the policies and regulations for ICT and, for that matter, OS. Secondly, the government has financial and human resources that could be spent on developing OS software and sponsoring promotional activities. The study has established that the private sector is more active than government in the support of OS communities. The government should, therefore, join hands with private donors to groom the growing OS industry in the country.

The study also established that OS communities experience difficulty in implementing their plans for promoting OS software. Accordingly, these communities need to evaluate their activities against the existing regulations and guidelines. The communities should also try to carry out some type of needs analysis to try and establish the actual needs of the kind of audience they want to target, so that they can tailor their practices to that group. This may help to address the problem noted in the study that programs are more advanced than is actually needed by or expected of an ordinary IT user. In addition, such an analysis would help practitioners to develop field-specific software so as to avoid unnecessary modifications, which could prove difficult and embarrassing for actual and potential consumers.

It has also been noted that educational institutions have not been exploited as a vehicle for accelerating the use of ICT and open source. This is also reflected in suggestions and observations made by respondents. Academic institutions constitute an appropriate avenue for implementing policies and other endeavours since through their curricula they have been entrusted with national development. As mentioned by a number of respondents and as evidenced by the literature, ICT and OS facilities could be made part of learning and teaching in these institutions. Computer studies are already in place in some schools and so ICT and OS could simply be added to the training programme. However, academic institutions are one of the places where OS could be in high demand and, therefore, promotional efforts should cover these institutions as well.

When asked to mention other strategies that could be used to promote OS software in addition to those previously outlined (see item 33 in the questionnaire), the participants' proposed the following:

- Competitions and bonanzas regarding the use of the facility
- Making use of small and medium enterprises (SMEs)
- Road shows
- Direct government involvement

7.7 Reflections

As a researcher I have learnt a lot in the course of this research work. Firstly, I have come to realise that I knew very little about the research process, particularly because I could see little relationship between the different parts of research process, beginning with the research problem formulation, theoretical paradigms and research design. At this stage, however, I am confident that I have a better understanding of how these parts fit together. Similarly, I have learnt that, as a researcher, one cannot always identify all the relevant issues; therefore, sharing research ideas with other people is an important part of making things clearer and more complete. This reminds me of the contributions and constructive criticism that I constantly received from my supervisors from whom I have learnt so much.

7.8 Further research

Further research should address the limitations noted in section 7.4 by involving a larger sample and drawing participants from different domains of use in different parts of Tanzania, including offline participants. In addition, future investigation should include political figures, policy makers and decision makers, particularly in ICT-related ministries and departments.

7.9 Conclusion

In this study three objectives were identified. The first objective pertained to the identification of ICT acceptance challenges in Tanzania. It is evident that Tanzania, like other developing countries, faces a number of ICT acceptance challenges ranging from the internal, social, economic and cultural environment to the legal and policy environment. In particular, resource

constraints have been found to be one of the major ICT acceptance challenges, as the majority of the population cannot afford the costs associated with proprietary software. These challenges were made evident in the literature analysis, as well as in the empirical findings of the study. In response to these challenges, however, OS has been found to address the issue of resource constraints given the fact that it can be distributed free of charge by the OS practitioners, particularly the OS communities, on condition that potential users are educated on the use and usefulness of the software.

This concurs with the ASA approach to technology acceptance (Verdegem and Verhoest 2008) presented in Figure 2.6, which relates to *access* to ICT, *skills* to master the devices and *attitudes* towards the technology. In other words, according to the ASA approach, technology acceptance is based on factors of ICT access, ICT skills and user attitudes towards ICT. The determinant of *access* in the ASA model seems to have a positive effect on the decision to accept ICT. Resource constraints can also be addressed by one of the features of OS – transferability – in that people can obtain the software from friends virtually free of licence restrictions.

Another feature of OS, which can also provide a solution to resource constraints as one of ICT acceptance challenges, is the fact that OS is modifiable and it can be used in various programs depending on the needs and convenience of the user. As the respondents could identify accessibility, affordability and modifiability as features of OS that can help to address resource constraints, it could be said that OS promotional activities could help to address ICT challenges

Another significant ICT acceptance challenge was identified as unfavourable local conditions that do not seem to put pressure on ICT acceptance. Although the challenges could be said to be universal across the developing world and beyond, some challenges such as context are country specific and, thus, solutions to them should be local. Modifiability, as one of the features of OS, can be relied upon to address the varied nature of ICT acceptance in suiting different uses. Otherwise, local conditions and resource limitations remain an issue with wider policy implications.

The second objective of the study was an attempt to assess the nature of OS promotion in Tanzania with a view to establishing the kind of activities carried out to address ICT acceptance challenges. By establishing the nature of OS promotional activities it would be possible to see how OS promotion could be tailored to the challenges identified by the first objective. In general,

OS promotion in Tanzania could be said to have evolved out of ICT acceptance challenges. Some of the OS promotional activities identified include the distribution of free OS software, the organisation of seminars and workshops, the establishment of online discussion forums and academic training in ICT skills and programs. However, these activities constantly interact with ICT acceptance challenges and so they have been both appreciated and criticised. For example, the distribution of free OS software has been found to be limited by demand in that people take the software and end up dumping it owing to the lack of an ICT demand-driven local environment. The conclusion is therefore that free software distribution is subject to differential sociocultural and economic conditions, which are essentially country specific. Therefore, free access as one of the features of OS may work differently across nations since it will also depend on, among other things, the extent to which people's occupations allow for the use of OS software, an awareness of the use and usefulness of ICT and so forth. Indeed, the features identified as characterising OS in Tanzania have the potential to address the challenges associated with ICT acceptance in the country. Free distribution could address the issue of low purchasing power that characterises the majority of the population, while transferability could do the same. Modifiability, on the other hand, allows for programs to be adapted to suit certain uses.

The third objective of the study was to establish the extent to which strategies employed in the promotion of OS in Tanzania have made an impact on the ICT acceptance challenges identified by the first objective. It is evident that efforts have been made by various stakeholders, including government, to address ICT acceptance challenges. Most importantly, OS promotion as a strategy employed in addressing the ICT acceptance challenges could be said to have been successful in Tanzania, as evidenced by the existing OS communities, particularly the ones involved in the study. Indeed, the OS communities are designed to address the conceived ICT acceptance challenges and this fact is reflected in the constitutions and regulations guiding the communities. However, the communities' documents that were examined contain strategies that could make OS a success in Tanzania, if only what is stated could be translated into action on the ground. Therefore, the major concern remains whether the strategies employed accomplish what they are intended to accomplish. With regard to OS communities, for instance, the researcher observed that practice did not really match the stated intentions: based on observation there seems to be a gap between what is articulated in the various constitutions and other relevant documents and what really happens on the ground.

In conclusion, the strategies employed in promoting OS in Tanzania could be said to address the challenges associated with ICT acceptance in the country, but certain conditions have to be met in order for these strategies to be practically implemented. As argued previously under the relevant sections in the previous presentations, seminars and workshops could work where people really need the software owing to the nature of their activities and if the necessary infrastructure such as electricity or alternative energy sources, internet connections and so forth are present. In the final analysis, it may be concluded that promotional strategies depend on the extent to which policy as a strategy creates a favourable environment in which other strategies can be implemented.

REFERENCES

- Aigrain, P., 2002. "Collaboration in OS Environments". *15th Bled Electronic Commerce Conference on e-Reality: Constructing the economy*, June 17-19, 2002 Bled: Slovenia, available from <[https://domino.fov.uni-mb.si/proceedings.nsf/Proceedings/385D066652806C88C1256E9F00393E09/\\$File/Aigrain.pdf](https://domino.fov.uni-mb.si/proceedings.nsf/Proceedings/385D066652806C88C1256E9F00393E09/$File/Aigrain.pdf)> [Accessed 17 February 2012].
- Allen, A. and Slutsky, R., 2003. "Can an electronic mailing list help build community and increase undergraduate cognition?." *International Electronic Journal for Leadership in Learning*, University of Calgary Press, Canada, 7(1), available from <http://www.ucalgary.ca/iejll/allen_slutsky> [Accessed 14 July 2011].
- Anandarajan, M. M., Igbaria and Anakwe, U., 2002. "IT acceptance in a less developed-country. A motivational factor perspective". *International Journal of Information Management*. Elsevier, Netherlands, 22(1):47-65.
- Asiri, S., 2003. "Open Source Software". *ACM SIGCAS Computers and Society*, ACM, New York, USA, 33(1), available from <<http://web.njit.edu/~bieber/CIS677F04/asiri-open-source.pdf>> [Accessed 17 February 2012].
- Attardi, G. and Zorzetti, G., 1999. "Implementing an interactive discussion forum". *Workshop on community based interactive systems*, Sienna, Italy, available from <<http://www.di.unipi.it/~attardi/Paper/IDF.pdf>> [Accessed 17 February 2012].
- Abhiyan S.S 2011, "Action Research (A document)", Distance Education program, Maidan Garhi, New Dheli, India, available at <http://depssa.ignou.ac.in/wiki/images/5/57/Action_Research.pdf> [Accessed 17 January 2012].
- Baskerville, R., 1999. "Investigating information systems with action research", *Communications of the AIS*, Association for Information Systems, New York, USA 2(19):1-32.
- Baxter, P. and Jack, S., 2008. "Qualitative case study methodology: Study design and implementation for novice researchers". *The Qualitative Report* December 2008, Nova Southeastern University, Florida, USA, 13(4):544-559.

- Benslimane, Y., Plaisent, M. and Bernard, P., 2003. "Applying the Task-Technology Fit Model to www-based Procurement: Conceptualization and Measurement". *Proceedings of the 36th Hawaii International Conference on System Sciences*, IEEE, 6-9 January 2003, Hawaii, USA, available from < <http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8360>> [Accessed 17 February 2012].
- Bierman, W. and Mtsweni, H., 2008. "An Investigation into the Implementation of Open Source Software within the SA Government. An Emerging Expansion Model". *Proceedings of the 2008 annual research conference of the South Africa Institute of Computer Science and Information Technologists on IT research in developing countries*, ACM, 6-8 October 2008, Garden Route, Wilderness: South Africa, pages 148-158.
- Biswas, A. and Singh, J., 2006. "Software Engineering Challenges in New Media Applications". *Software Engineering Applications*, ACTA Press, Dallas, Texas, USA, available from <http://idi.ntnu.no/~letizia/tdt69/bib/NewMedia_SE_BiswasSingh.pdf> [Accessed 17 February 2012].
- Björgvinsson T., Thorbergsson H. and Valfell Á., 2007. "Economic benefits of free and open source software in electronic governance", *The 2007 International Conference on Theory and Practice of Electronic Governance*, 10-13 December 2007, Macao, S.E.R China, available at < <http://www.icegov2007.icegov.org/slides/ICEGOV2007%20EconomicsWorkshopPresentation4.pdf>> [Accessed 17 February 2012].
- Bonaccorsi, A. and Rossi, C., 2005. "Why Profit- oriented Companies Enter the OS Field? Intrinsic Vs Extrinsic Incentives", *ACM SIGSOFT Software*, July 2005, Engineering Notes, New York, USA, 30(4):47-51.
- Bonaccorsi, A. and Rossi, C., 2006. "Comparing Motivations of Individual Programmers and Firms to Take Part in the Open Source Movement. From Community to Business. Laboratory of Economics and Management". *Knowledge, Technology & Policy*, SpringerLink, Berlin, Germany, 18(4): 40-64.

- Bourque, P., Dupuis, R., Abran, A. and Moore, J.W., 2004. "Guide to the software engineering body of knowledge". *Proceedings 10th International Workshop on Software Technology and Engineering Practice*, IEEE Press, 6-8 October 2002, New York: USA, pages 8:23.
- Braa, J., Monteiro, E. and Sahay, S., 2004. Networks of Action: Sustainable health information systems across developing countries, *MIS Quarterly*, Management Information System Research Center, University of Minnesota, Minnesota, USA 28(3):337–362.
- Bridges.org., 2005. "Comparison Study of Free/Open Source and Proprietary Software in an African Context. Implementation and Policy-Making to Optimize Public- Access to ICT". available at <http://www.bridges.org/files/active/0/SoftComp_Final_24May05r.pdf> [Accessed 4 Jan 2011].
- Bruggink, M. 2003. "Open Source in Africa: Towards Informed Decision-Making". *Research Brief No 7*, International Institute for Communication and Development, 1 August 2003, The Hague, Netherlands, available from <<http://www.iicd.org/files/Brief7.pdf>> [Accessed 17 February 2012].
- Camara, G. and Fonseca, F., 2007. "Information Policies and Open Source Software in Developing Countries". *Journal of the American Society for Information Science and Technology*, John Wiley&Sons, New York, USA 58(1):121–132.
- Carmichael, P. and Honour, L., 2002. "Open Source as Appropriate Technology for Global Education", *International Journal of Educational Development*, Elsevier, Amsterdam, The Netherlands, 22(1): 47-53.
- Chonia, G., 2003. "Free and Open Source Software in Africa: Round Table on Developing Countries Access to Scientific Knowledge". The Abdus Salam ICTP, Trieste, Italy, available at <<http://www.ejds.org/meeting2003/ictp/papers/Gideon.pdf>> [Accessed 17 February 2012].
- Chismar, W.G. and Patton W.S., 2002. "Does the Extended Technology Acceptance Model Apply to Physicians?" *Proceedings of the Twenty-sixth Conference of the American Medical Informatics Association Symposium*, IEEE Computer Society, 9-13 November 2002, San Antonio, Texas, pages 1-8.

- Cisco Systems, 2009. "Using collaborative tools - IRC and IM", Cisco Systems Inc, San Jose, California, USA, Available at <<http://westcompsci.pima.edu/~revans/CIS170/labs/Activity1.6.1%20Using%20Collaboration%20Tools-IRC%20and%20IM.pdf>> [Accessed 27 December 2010].
- Coghlan, D. and Brannik, T., 2004. "Doing Action Research in your own Organization", SAGE Publications, London, UK.
- Coghlan, D. and Casey, M., 2001. "Action research from the inside: issues and challenges in doing action research in your own hospital", *Journal of advanced nursing*, PubMed, USA 35(5):674-682.
- Coita, D. and Abrudan, M., 2007. "Electronic mailing lists and internet forums-tools for management and marketing within educational organizations." *Research Paper in Economics*, Missouri, USA, 5(1):77-81.
- Compeau, D.R., and Higgins, C.A., 1995a. "Computer Self-Efficacy: Development of a Measure and Initial Test", *MIS Quarterly*, Management information systems research centre, University of Minnesota, Minnesota, USA, 19(2): 189-211.
- Compeau, D. R., & Higgins, C. A., 1995b. "Application of social cognitive theory to training for computer skills". *Information Systems Research*, 6(2): 118-143.
- Dalcher, D. and Drevin, L., 2003. "Learning from Information Systems Failures by Using Narrative and ante- narrative Methods". *South African Computer Journal*, South African Institute for Computer Scientists and Information Technologists, Republic of South Africa, 19(1):88-97.
- Danowitz, A., Nassef, Y. and Goodman, S., 1995. "Cyber Space across the Sahara: Computing in North Africa". *Communications of the ACM*, New York, USA, 38 (12):23-28.
- Darke , P., Shanks, G. and Broadbent, M., 1998. "Successfully completing case study research: combining rigour, relevance and pragmatism". *Information Systems Journal*, John Wiley&Sons, New York, USA 8(4):273-289.

- Davis, F., 1989. "Perceived usefulness, perceived ease of use, and user acceptance of information technology". *MIS Quarterly*, Management information systems research centre, University of Minnesota, Minnesota, USA 13(3):319-340.
- Davis, F. D., 1986. "A Technology Acceptance Model for Empirically Testing New End-user Information Systems: Theory and Results". *Dissertation*, Massachusetts Institute of Technology, Massachusetts, USA, 1:219.
- Dedrick, J. and West, J., 2003. "Why firms adopt open source platforms: A grounded theory of innovation and standards adoption." Proceedings of the *workshop on standard making: A Critical research frontier for information systems*, Cite Seer, 12-14 December 2003, Seattle, Wash, USA, (1):236-257.
- Denzin, N. K., 1978. "The research act: A theoretical introduction to sociological methods(2nd ed.)" McGraw-Hill, New York, USA.
- Denzin, K. and Lincoln, Y. S., 1994. "Handbook of Qualitative Research", SAGE, Thousand Oaks, Ca, USA.
- Dionisio, J., Dickson, C., August, S., Dorin, P. and Toal, R., 2007. "An Open Source Software Culture in the Undergraduate Computer Science Curriculum". *ACM SIGCSE Bulletin*, New York, USA 39(2):70-74.
- Dishaw, M. and Strong, D., 1998. "Extending the Task Technology Fit model with Self-efficacy Constructs". *Information & Management*, Elsevier, Amsterdam, The Netherlands 36(1):9-21.
- ECA., 2000. "Africa and the information economy: foundations, opportunities, challenges and research agenda". *Economic Commission for Africa*, Addis Ababa, Ethiopia, available at < <http://www.uneca.org/aknf/pub/informationeconomy.pdf> > [Accessed 17 February 2012].
- Edubuntu., 2012. "The Tanzanian Community Ubuntu Users" available at < <https://wiki.edubuntu.org/TanzanianTeam> > [Accessed 8th March 2012].
- Ellis, H., Morelli, R., Lanerolle, T., Damon, J. and Raye., 2007. "Can humanitarian open-source software development draw new students to CS?" *Proceedings of 38th SIGCSE technical*

symposium on Computer science education, ACM, 7-11 March 2007, Convington, Kentucky, USA, 39(1):551–555.

Evaluation Briefs, 2008. “Data collection methods for program evaluation: Observation”. Department of Health and Human Services, Available at <<http://www.cdc.gov/healthyyouth/evaluation/pdf/brief16.pdf>> [Accessed 28 February 2011].

Evans, D. and Reddy, B., 2002. “Government preference for promoting open source software: A solution in search of a problem”. *Michigan telecommunications and technology law. Review*, Technology Academics Policy, Michigan, USA, 9(2):313-394.

Evers, S., 2000, “An Introduction to open source software development,” *Diploma dissertation*, Technische University, Berlin, available at < <http://user.cs.tu-berlin.de/~tron/opensource/opensource.pdf> > [Accessed 25 May 2011].

Fishbein, M. and Ajzen, I., 1975, “Belief, attitude, intention and behavior: An Introduction to Theory and Research” Addison-Wesley, Reading, Massachusetts, USA.

Ford, R., 2007. “Open Vs closed: Which source is more secure?” *ACM QUEUE*, New York, USA 5(1):34-38.

Fuggeta, A. and Cerri, D., 2007. “Open standards, open formats, and open source”. *Journal of systems and software*, Elsevier Science Inc, Amsterdam, The Netherlands, 80(11):1930-1937.

Gallego, M., Luna, P. and Bueno, S., 2007. “User acceptance model of open source software” *Journal of Computers in Human Behavior*, Elsevier Science Inc, Amsterdam, The Netherlands 24(5): 2199-2216.

Gallego, M., Luna, P. and Bueno, S., 2008. “User acceptance model of open source software”, *Journal in computers and human behaviour*, Elsevier Science Publishers, Amsterdam, The Netherlands, 24(5):2199-2216.

Gallupe, R., 2007. “The tyranny of methodologies in information systems research”, *ACM SIGMIS Database*, New York, USA, 38(3): 20-28.

Gebauer, J., Shaw, M. and Gribbins, M., 2006. “Task-Technology Fit for mobile information systems”. *Working papers*, First Monday Editorial group, Chicago, USA. Available at <

http://www.business.illinois.edu/Working_Papers/papers/06-0107.pdf > [Accessed 2nd May 2011].

Gelderblom, J.H., Van Dyk, T.J and Van Biljon, J.A., 2010. "Mobile phone adoption: Do existing models adequately capture the actual usage of older adults?" *Proceedings of the 2010 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists (SAICSIT 2010)*, ACM, Bela bela, South Africa pages 67-74.

Genzuk, M., 2003. "A synthesis of ethnographic research", University of California, California, USA, available at < http://www.bcf.usc.edu/~genzuk/Ethnographic_Research.pdf> [Accessed 18 June 2011].

Ghosh, R., 2003. "License fees and GDP per capita: The case for open source in developing countries". *Journal of the Internet*, First Monday Editorial group, Chicago, USA 8(12). Available at < <http://www.mendeley.com/research/case-open-source-developing-countries/>> [Accessed 18 August 2011].

Ghosh, R., Glott, R., Krieger, B. and Robles, G., 2002. "Free Libre and open source software: Survey and study", International Institute of Informatics, University of Maastricht and Berlecon, The Netherlands, available at < <http://www.math.unipd.it/~bellio/FLOSS%20Final%20Report%20-%20Part%204%20-%20Survey%20of%20Developers.pdf> > [Accessed 17 February 2012].

Godfrey, L., 2006. "The importance of information system design improvisation in meeting the needs of an emerging democracy in South Africa, a case study of a national waste information system", *EnviroInfo*, CSIR, Pretoria, South Africa, Available < http://researchspace.csir.co.za/dspace/bitstream/10204/3278/1/Godfrey1_2006.pdf>e [Accessed 26th April 2011].

Goede, R. and De Villiers, C., 2003. "The applicability of Grounded Theory as research methodology in studies on the use of methodologies in IS practices". *Proceedings of the 2003 annual research conference of the South Africa institute of computer scientists and information technologists on Enablement through technology*, ACM, 17-19 September 2003, Fourways, South Africa 47:208-217.

- Gokturk, E., 2004. "What is paradigm?" Department of Informatics, University of Oslo, Oslo, Norway, available at < <http://pdffinder.net/The-definition-of-paradigm,-in-a-general-context> > [Accessed 17 February 2011].
- Golbeck, J. and Mutton, P., 2004. "Semantic web interaction on internet relay chat", *Proceeding of interaction design on the semantic web*, CiteSeer, New York, USA, available at < <http://www.mendeley.com/research/semantic-web-interaction-internet-relay-chat/>> [Accessed 17 February 2012].
- Goodhue, D. and Thompson, R., 1995. "Task-Technology Fit and individual performance", *MIS Quarterly*, Management Information System Research Center, University of Minnesota, Minnesota, USA 19(2):213-236.
- Government Technology, 2006. "Open source special report: Separating fact from fiction" e.Republic Inc, California, USA, Available at: <<http://www.govtech.com/library/case-studies/Open-Source-Special-Report-Separating-Fact.html>> [Accessed 5th April 2011].
- Greenberg, A., 2005. "ICTs for poverty alleviation: Basic Tool and Enabling Sector" *ICT for Development Secretariat*, Department for infrastructure and Economic Cooperation, SIDA, Canada November 2005. Available at www.sida.se/publications [Accessed 3rd June 2012]
- Gupta, B., Dasgupta, S. and Gupta, A., 2008. "Adoption of ICT in a government organization in a developing country: An empirical study", *Journal of strategic information systems*, Elsevier, The Netherlands, 17(2):140-154.
- Hamner, M. and Qazi, R., 2009. "Expanding the Technology Acceptance Model to examine personal computing technology utilization in government agencies in developing countries". *Government information quarterly*, Elsevier, The Netherlands 26(1):128-136.
- Hansen, M., Kohntopp, K. and Pfitzmann, A., 2001. "The Open Source approach opportunities and limitations with respect to security and privacy", *Computers Security*, Elsevier, The Netherlands, 21(5):461-471.
- Harrel, M. and Bradley, M., 2009. "Data collection methods: Semi structured interviews and focus groups". RAND Corporation, Santa Monica, California, USA, available from www.rand.org [Accessed 11 February 2011].

- Haveliwala, T., 2002. "Search facilities for Internet relay Chat", Proceedings of the 2nd ACM/IEEE joint conference on Digital Libraries, 13-17 July 2002, Portland, Oregon, USA, available at < <http://research.taherh.org/pubs/ircweb.pdf> > [Accessed 17 February 2012].
- Heeks, R., 2002. "Failure, success and improvisation of information systems projects in developing countries", *The Information Society*. Institute for Development Policy and Management, University of Manchester, Manchester, England, 1(1):1-20.
- Heeks, R., 2002, "e-Government in Africa: Promise and practice. e-Government working paper series", *Journal of Information polity*, ACM Digital Library, Amsterdam, The Netherlands, 7(2):1-26.
- Heeks, R., 2009. "Emerging markets, IT and the world's "bottom billion". How can information technology be best applied to address problems and provide opportunities for inhabitants of the world's poorest countries?" *Communications of the ACM*, New York, USA, 52(4):22-24
- Helic, D., Maurer ,H. and Scerbakov, N., 2004. "Discussion forums as learning resources in web-based education", Institute for information processing and computer Supported New Media, Graz University of Technology, Austria, available at < <http://coronet.iicm.edu/denis/pubs/ijca2004.pdf> > [Accessed 17 February 2012].
- Hoepman, J.H. and Jacobs, B., 2007, "Increased security through open source", *Communications of the ACM*, New York, USA 50(1):79-83.
- Hughes, B. and Johnston, P., 2005. "Sustainable futures: policies for global development". Elsevier, Amsterdam, The Netherlands, 37(8):813-831.
- Hussain, M. and Oshikoya, T., 1998. "Information technology and the challenge of economic development in Africa", *African development Review*, John Wiley&Sons, New York, USA, 10(1):100-133.
- Ezz, E., 2005. "The Role of ICT in Sustainable Development: Some Challenges for Developing Countries", *55th Pugwash Conference on science and world affairs*, 22-27 July 2005 Hiroshima, Japan, pages 55:1-16.
- Jack, S. and Baxter, P., 2008. "Qualitative case study methodology: Study Design and Implementation for Novice Researchers", *The Qualitative report*, Nova Southerneastern University, Florida, USA, 13(4):2008.

- Johnson, J., 2006. "Collaboration, peer review and open source software", *Information Economics and Policy*, Elsevier, Amsterdam, The Netherlands, 18(4):477-497.
- Johnson, R.B., Onwuegbuzie, J.A. and Turner, A.L., 2007. "Toward a definition of Mixed Methods Research", *Journal of Mixed Methods Research*, SAGE Publications, Thousand Oaks, California, USA, 1(2):112-113.
- Karels, M., 2003. "Commercializing Open Source Software", *ACM. QUEUE*, New York, USA, 1(5):46-55.
- Katz, A., 2008. "Open Source: History", Available at <<http://www.moorcrofts.com/documents/Open%20Source%20-%20History.pdf>> [Accessed 16 March 2011].
- Keats, D.W., 2003. "Collaborative development of open content: A process model to unlock the potential for African universities," *Journal of the Internet, First Monday*, Editorial Group, University of Illinois, Chicago, USA, 8(2) available from <<http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/viewArticle/1782>> [Accessed 7 February 2011].
- Keats, D.W., Beebe, M.A and Kullenberg, G., 2003. "Using the Internet to enable developing country universities to meet the challenges of globalization through collaborative virtual programmes," *Journal of the Internet, First Monday* Editorial Group, University of Illinois, Chicago, USA, 18 (10):1-13.
- Keats, D.W. and Beebe, M.A., 2004. "Addressing digital divide issues in a partially online masters programme in Africa: The NetTel@Africa experience," *Fourth IEEE International Conference on Advanced Learning Technologies, 30 August- 1 September 2004, Joensuu, Finland*, available from <<http://ieeexplore.ieee.org>> [Accessed 17 March 2011].
- Klein, H.K. and Myers, M.D., 1999. "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly, Special Issue on Intensive Research*. 23(1):67-93.
- Klnx, 2012 "The Kiswahili Linux localization project" Department of Computer Science and Engineering – UDSM. Available at <<http://www.kilinux.udsm.ac.tz/>> [Accessed 25th January 2012]

- Klopping, I. and McKinney, E., 2004. "Extending the technology acceptance model and the task technology fit model to consumer e-commerce". *Information technology, learning and performance journal*, Organizational Systems Research Association, Morehead, USA, 22(1):35-48.
- Kogut, B. and Metiu, A., 2001. "Open source software development and distributed innovation". *Oxford review of economic policy*, Oxford University press, Oxford, United Kingdom, 17(2):248-264.
- Kortermann, M. 2005., "Cultural background and technology acceptance: Evaluation of ICT projects that bridge the digital divide". The International Workshop on Internationalization of Products and Systems (*IWIPS*), 7-9 July 2005 Amsterdam, The Netherlands, pages 151-158.
- Lakhani, K., Spaeth, S. and Von Krogh, G., 2003. "Community, joining, and specialization in open source software innovation: A case study: *Research Policy* Elsevier Science, Amsterdam, The Netherlands, 32(7):1217-1241.
- Lanzi, D., 2009. "Competition and open source with perfect software compatibility". *Information economics and policy* Elsevier, Amsterdam, The Netherlands, 21(3):192-200.
- Lee, G.K. and Cole, R., 2003. "From a firm-based to a community-based model of knowledge creation: The case of the Linux kernel development," *A journal of the institute for operations research and management sciences, INFORMS, Hanover, USA*, 14(6):633-649.
- Lee, J.S., Cho, H., Gay, G., Davidson, B., and Ingraffea, A., 2003. "Technology Acceptance and Social Networking in Distance Learning". *Educational Technology & Society*, International Forum of Educational Technology and Society, USA, 6(2):50-61.
- Lee, S., Kim, H. and Gupta, S., 2007. "Measuring open source software success". *The International Journal of Management Sciences* Elsevier, Amsterdam, The Netherlands, 37(2):426 – 438.
- Leuf, B. and Cunningham, W., 2001. "The wiki way: Quick collaboration on the web", Addison Wesley, Boston, USA.
- Lewis, J., 2008. "Government Open Source policies July 2008, center for strategic and international studies", *Center for Strategic & International Studies (CSIS)*, Washington,

USA, Available at <http://csis.org/files/media/csis/pubs/0807218_government_opensource_policies.pdf>[Accessed 4 January 2011].

Leedy, Paul, D. and Ormrod, J. E., 2001. "Practical research: planning and design", Prentice Hall, New Jersey, USA.

Lin, L., 2007. "Impact of user skills and network effects on the competition between open source and proprietary software". *Journal of Electronic Commerce Research and Applications*, Elsevier Science, Amsterdam, The Netherlands, 7(1):68-81.

Linda, K., 1997, "Methods in case study analysis", The Center for Studying Health System Change. (SHC), Technical Publication 2 June 1997 USA, available at <http://webanketa.com/direct/upload/books/en/methods_in_case_study_analysis_by_linda_t_kohn.pdf>[Accessed 6 February 2011].

Lopez, S., Masera, O. R. and Astier, M., 2002. "Evaluating sustainability of complex socio-environmental systems The MESMIS framework". *Ecological indicators*, Elsevier, Amsterdam, The Netherlands, 2 (1-2):135-148.

Lynda, J., Harvey, Myers, M.D., 1995 "Scholarship and practice: the contribution of ethnographic research methods to bridging the gap", *Information Technology & People*, Emerald Group Publishing Ltd, Bradford, West Yorkshire, England 8(3):13 – 27.

Magni, M. and Pennarola, F., 2008, "Intra-organizational relationships and technology acceptance". *International Journal of Information Management*, Elsevier, Amsterdam, The Netherlands, 28(6):517-523.

Magnusson, M. and Dahlander, L., 2008, "How do firms make use of Open source communities?" *Strategic Direction*, Emerald Group Publishing Ltd, Bradford, West Yorkshire, England, 25(6):628-649.

Mannaert, H. and Ven, K., 2007, "Challenges and strategies in the use of Open Source software by independent software vendors". *Information and Software Technology*, Elsevier, Amsterdam, The Netherlands, 50(9-10):991-1002.

Marshall, C. and Rossman, G., 2010. "Designing Qualitative Research". Fifth edition. SAGE Publications, California: USA.

- Massingue, V., 2003. "A long-term vision for building ICT skills and capacity in Mozambique", Acacia Conference 1-3 October 2003 Konigswinter, Germany, available at < http://web.idrc.ca/en/ev-117227-201-1-DO_TOPIC.html> [Accessed 16 May 2011].
- McKendrik, J., 2007, "Open Source in the enterprise. New software disrupts the technology stack". *Independent Oracle Users group (IOUG)*, USA, Available at < <http://www.immagic.com/eLibrary/ARCHIVES/GENERAL/GENPRESS/U070904M.pdf> > [Accessed 25 June 2011].
- Meiszner, A., 2007, "Communication tools in FLOSS communities: A look at FLOSS communities at large-beyond the development team", *IADIS international conference on web based communities*, 19 February 2007, Salamanca, Spain, pages 111-117.
- Merriam-Webster., 2011. An encyclopedia Britannica company, available at < <http://www.merriam-webster.com/dictionary/usage>> [Accessed 24 December 2011].
- Misuraca, G., 2005, "e-Governance in Africa, from the theory to action: a practical-oriented research and case studies on ICTs for local governance". *Proceedings of the 2006 international conference on Digital government research*, ACM, 21-24 May 2006, San Diego, California, USA, pages 209-218.
- Moore, G. C. and Benbasat, I., 1991. "Development of an instrument to measure the perceptions of adopting an information technology innovation" *Information Systems Research*, INFORMS, Linthicum, Maryland, USA 2(3):173-191.
- Mountz, A., Moore, E.B. and Brown, L., 2008, "Participatory action research as pedagogy", *An International E-Journal for Critical Geographies*, ACME Editorial, New York, USA 7(2):214-238.
- Mushi, A., 2007, "ICT Research Opportunities and Challenges: The case of Tanzania", University of Dar-es-Salaam, Tanzania, available from < <http://euroafrica-ict.org/>> [Accessed 17 February 2011].
- Myers, M.D., 1999. "Investigating Information Systems with Ethnographic Research," *Communication of the AIS*, Association for Information Systems, New York, USA 2(23):1-20

- Nakakoji, K., Yamamoto, Y., Nishinaka, Y., Kishida, K. and Yunwen, Y., 2002. "Evolutions patterns of open source software systems and communities". *Proceedings of the international workshop on Principles of software evolution*, ACM, 19-20 May 2002, Orlando, FL, USA, pages 76-85.
- Nauman, A., Aziz, R. and Ishaq, A., 2005, "Information Systems Development Failure: A Case Study to Highlight the IS Development Complexities in Simple, Low Risk Projects in Developing Countries". *The Second International Conference on Innovations in Information Technology (IIT)*, 26-28 September, Dubai, UAE, Available from < <http://www.mendeley.com/research/information-systems-development-failure-case-study-highlight-development-complexities-simple-low-risk-projects-developing-countries/>> [Accessed 3rd June 2011].
- Neale, P., Thapa, S. and Boyce, C., 2006. "Preparing a Case Study: A Guide for Designing and Conducting a Case Study for Evaluation Input". Pathfinder International, Watertown, Massachusetts, USA.
- Oates, B.J., 2006. "Researching Information Systems and Computing", SAGE Publications, Thousand Oaks, California: USA.
- O'Brien, J., 2003. "Management Information Systems: Managing Information Technology in the E-Business Enterprise, 6th Edition", McGraw-Hill, New York: USA.
- OECD, 2004. "E-Government Studies: The e-Government Imperative", OECD Publishing, Paris, France, available at < <http://pavroz.ru/dov/egovimperative.pdf> > [Accessed 15 May 2011].
- O'Grady, S., Governor, J. and Cote, M., 2007, "Open Source strategies: The Redmonk Going open source series, part 2", RedMonk, USA, Available at <<http://redmonk.com/public/goingopensource/Open-Source-Strategies.pdf>> [Accessed 26 May 2011].
- Open Source Initiative, 2001. 'The Open Source Definition', Available at www.opensource.org/docs/osd [Accessed 15 February 2011].

- O'Reilly, T., 1999, "Lessons from Open Source software development", *ACM*, New York, USA, 42(4):33-37.
- Oreg, S. and Nov, O., 2007, "Exploring motivations for contributing to open source initiatives: The roles of contribution context and personal values". *Journal of Computers in human behavior*, Elsevier Science, Amsterdam, The Netherlands, 24(5): 2055-2073.
- Osterlie, T., Sampson, J. and Berntsen, K., 2004, "Interpretive research methods in computer science", Norwegian University of Science and Technology, Trondheim, Norway, available at < <http://www.idi.ntnu.no/~thomasos/paper/interpretive.pdf> > [Accessed 15 April 2011].
- Ouédraogo, L., 2005. "Policies of United Nations system organizations towards the use of open source software (OSS) in the secretariats", United Nations, Geneva, Available at < http://www.unjju.org/data/reports/2005/en2005_3.pdf > [Accessed 2nd May 2011].
- Paris, L., 2002. "IASSIST Collaboration in Africa", *IASSIST Quarterly*, International Association for Social Science Information Services & Technology, Available at <<http://www.iassistdata.org/content/iassist-collaboration-africa>> [Accessed 9 November 2010].
- Patton, M.A., 2002. "Qualitative Research & Evaluation Methods" 3rd ed. Sage Publication, London, UK.
- Pedroni, M., Bay, T., Oriol, M. and Pedroni, A., 2007. "Open source projects on programming courses", *Proceedings of the 38th SIGCSE technical symposium on Computer Science education*, ACM SIGCSE bulletin, 7-11 March 2007, Covington, KY, USA, 39(1):454-458.
- Pinsonneault, A. and Kraemer, K., 1993. "Survey research methodology in management information systems: An assessment". *Journal of Management Information Systems-Special section: Strategic and competitive information systems*, Sharpe Inc, Armonk, USA, 10(2):31-31.
- Pogue, T. and Day, B., 2004. "Free/Libre& Open Source Software and Open Standards in South Africa. A Critical Issue for Addressing the Digital Divide", *National Advisory Council on Innovation*, South Africa, Available at < http://www.naci.org.za/pdfs/floss_v2_6_9.pdf>. [Accessed 9 July 2011].

- Prasad, N., 2009. "ICT enabled services in fertilizer marketing management", Chamber Fertiliser and Chemicals Limited, Available at <<http://www.faidelhi.org/training%20programme/ICT-09/Workshop%20at%20Manali/PDF%20files/N%20Prasad.pdf>> [Accessed November 2011].
- Riemer, F., 2008. "Addressing ethnographic inquiry", *Research essentials*, Jossey Bass Publishers, New Jersey, USA, available at <http://media.wiley.com/product_data/excerpt/95/04701810/0470181095-2.pdf> [Accessed 20 April 2011].
- Ross, K., Clark, L. and Renckly, T., 2002. "Air University, Sampling and Surveying Handbook: Guidelines for planning, organizing and conducting surveys", US Airforce, Alabama, USA, available at <<http://www.au.af.mil/au/awc/awcgate/edref/smpl-srv.pdf>> [Accessed 14 May 2011].
- Rota, S. and Osterloh, M., 2007. "Open source software development-Just another case of collective invention?" *Research Policy*, Elsevier, Amsterdam, The Netherlands, 36(2):157-171.
- Samah, B., Shaffril, H., Hassan, M. and D'Silva, J., 2011. "Can Technology Acceptance Model be applied on Rural Setting? The case of village development and security committee in Malaysia". *Journal of Social Sciences*, Science Publications, New York, USA, 7(2):113-119
- Sandberg, K. and Wahberg, O. 2006. "Towards a Model of the Acceptance of Information and communication Technology in Rural Small Businesses", Mid Sweden University, Sweden, available at <<http://www.ncsb2006.se/pdf/Towards%20a%20Model%20of%20Acceptance.pdf>> [Accessed 20 August 2011].
- Satchell, J. and Peeling, N., 2001. "Analysis of the impact of Open source software", QinetiQ Ltd. Available at <http://www.govtalk.gov.uk/documents/QinetiQ_OSS_rep.pdf> [Accessed 25th March 2011].
- Scacchi, W., 2007. "Open source software development: recent research results and emerging opportunities". *The 6th Joint meeting on European software engineering conference and the*

ACM SIGSOFT symposium on the foundations of software engineering, ACM, 3-7 September 2007, Cavat near Dubrovnik, Croatia, (1):459-468.

Schaper, L. and Pervan, G., 2004. "A model of information and communication technology acceptance and utilization by occupational therapists", *IFIP international conference on decision support systems*, Curtin University of Technology, 1-3 July 2004, Prato, Italy, available from < <http://www.questionpro.com/academic/975.html>> [Accessed 24 October 2011].

Schepers, J. and Wetzels, M., 2006. "A meta-analysis of the technology acceptance model: investigating subjective norm and moderation effects", *Information & Management*, Elsevier, Amsterdam, The Netherlands, 44(1):90-103.

Schepers, J. J. L. and Wetzels, M. G. M., 2006. "Technology acceptance: a meta-analytical view on subjective norm", In Proceedings of the 35th European Marketing Academy Conference 23-26 May 2006, Athens, Greece.

Schroder, P. Schrettl, W. and Bitzer, J., 2006. "Intrinsic motivation in open sources software development". *Journal of comparative economics*, Elsevier, Amsterdam, The Netherlands, 35(1):160-169.

Shah, S., 2006. "Motivation, Governance, and the viability of Hybrid Forms in Open Source Software development". *Journal of Management Science*, Informs, Linthicum, Maryland USA, 52(7):1000-1014.

Shi, S., Hutchinson, S. M., Yuc, L. and Xua, S., 2001. "Towards a sustainable coast: An integrated coastal zone management framework for Shanghai, People's Republic of China." *Ocean & coastal management*, Elsevier, Amsterdam, The Netherlands, 44(5-6):411-427.

Silva, M. and Stubkjaer, E., 2002. "A review of methodologies used in research on cadastral development". *Computers, Environment and Urban Systems*, Elsevier, Amsterdam, The Netherlands, 26(5):403-423.

Singh, V., Twidale, M.B. and Nichols, D.M., 2009. "Users of open source software – How do they get help?" Proceedings of HICSS 42nd Hawaii International Conference, IEEE explore,

5-8 January 2009, Big Island, USA, available at < <http://ifipwg213.org/system/files/07-07-04.pdf>> [Accessed 28 February 2011].

Singh, J., 2005. "Open access: To be or not to be?" *Indian Journal of Pharmacology*, Publication of the Indian Pharmacological Society, India, 37(3): 139-140.

Srivastava, A. and Srinivasan, S., 2009. "Fibonacci: Spreading knowledge unrestrained", Students forum for free Open Source Software, ABV-Indian Institute of Information Technology and Management Gwalior, September 2009, India, 1(1):1-94.

Stahl, B., 2005. "The impact of open source development on the social construction intellectual property", *IGI Global 2005*, Hershey, Pennsylvania USA, available from < <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.101.671>> [Accessed 9 April 2011].

Stake, R., 1995, "The art of case research", Sage Publications, Thousand Oaks, California, USA.

Stam, W., 2009. "When does community participation enhance the performance of open source software companies?" *Research Policy*, Elsevier, Amsterdam, The Netherlands, 38(8):1288-1299.

Stasko, V. and Pousman, F., 2007. "Ambient information systems: Evaluation in two paradigms". *Proceedings of the 1st International Workshop on Ambient Information Systems*, 13 May 2007, Canada, Toronto, pages 254:25-29.

Steele, S. and Powell, E., 1996, "Collecting Evaluation Data: Direct Observation" Program Development and Evaluation, University of Wisconsin-Extension, Madison, Wisconsin, USA.

Sturmer, M., 2005. "Open source community building", *Dissertation*, University of Bern, Switzerland, available from < <http://foss.mit.edu/>> [Accessed 21 September 2011].

Sun, H. and Zhang, P., 2005. "The role of moderating factors in user technology acceptance". *International journal of human-computer studies*, MIS Quarterly & The Society for Information Management, USA, 64(2):53-78.

Tanzania Development Gateway., 2003. "Open source to leapfrog the digital divide in Tanzania", Development Gateway, Available at

http://www.developmentgateway.org/node/285491/news/item?item_id=761336[Accessed 19 February 2011].

TAFOSSA., 2006, “Tanzania Free and Open Source Software Association Constitution”, Tanzania Free and Open Source Software Association, Available at <<http://tafossa.blogspot.com/>> [Accessed 5 October 2010].

The Dravis Group., 2003. “Open source software: Case study examining its use”. *The Dravis group LLC*, San Francisco, USA, available at < <http://lwn.net/Articles/30241/>> [Accessed 13 January 2011].

The Health Communication Unit., 1999. “Conducting Survey”, The Health Communication Unit, University of Toronto, Toronto, Canada.

The Health Communication Unit., 1999. “Conducting Survey Research”, Centre for Health Promotion, University of Toronto, Toronto, Canada, available at <http://www.esfagentschap.be/uploadedFiles/Voor_ESF_promotoren/Zelfevaluatie_ESF-project/niet%20experimenteel%20onderzoek.pdf> [Accessed 10 May 2011].

Thorbergsson, H., Björgvinsson, T. and Valfell, A., 2007. “Economic benefits of free and open source software in electronic government”, *Proceedings of the 1st International Conference on Theory and Practice of electronic governance*, ACM, 10-13 December 2007, Macao Sar, China, available from < <http://dl.acm.org/citation.cfm?id=1328095>> [Accessed 24 June 2011].

Thorbergsson, H. and Björgvinsson, T., 2007. “Software development for governmental use utilizing free and open source software”. *Proceedings of the 1st International Conference on Theory and Practice of electronic governance* ACM, 10-13 December 2007, Macao Sar, China, available from < <http://dl.acm.org/citation.cfm?id=1328095>> [Accessed 10 November 2011].

Tibenderana, P. and Ogao, P., 2008. “Information communication technologies acceptance and use among University communities in Uganda: A model for hybrid library services end-users”. *International Journal*, Mendeley, Toronto, Canada, 1(1):391-410.

Tirole, J. and Lerner, J., 2001. “The open source movement: Key research questions”. *European Economic review*, Elsevier, Amsterdam, The Netherlands, 45(4-6):819-826.

- Tirole, J. and Lerner, J., 2000. "The simple economics of open source. HBS Finance working paper no. 00-059", Harvard Business School, USA Available at <<http://www.hbs.edu/research/facpubs/workingpapers/papers2/9900/00-059.pdf>> [Accessed 6 February 2011].
- TLUG, 2012. "Tanzania Linux User Group" Available at <http://tzlug.org> [Accessed 5th February 2012].
- Tomhave, B. 2005. "Alphabet soup: Making sense of models, frameworks, and methodologies", secure consulting, Available at <www.secureconsulting.net/Papers/Alphabet_Soup.pdf > [Accessed 20 March 2011].
- UNCTAD., 2007. "The least developed countries report 2007: Knowledge, technological learning and innovation for development", United Nations, Geneva, Switzerland, available at < http://www.unctad.org/en/docs/ldc2007_en.pdf > [Accessed 17 February 2012].
- United Nations, 2003. "E-commerce and development report: Free and open source software: Implications for ICT policy and development", United Nations Conference on Trade and Development, United Nations, 20 November 2003, Palais des Nations, Geneva, Switzerland, pages 95-134.
- URT, 2003. "National information and communications technology policy", Ministry of Communications and Transport, Dar-es-Salaam, Tanzania, available at < <http://www.tanzania.go.tz/pdf/ictpolicy.pdf> > [Accessed 5 May 2011].
- Usoro, A. and Shoyelu, S., 2010. "Task-technology fit and technology acceptance models applicability to e-tourism" *Journal of Economic Development, Management, IT, Finance and Marketing*, Global Strategic Management Inc, Michigan, USA, 2(1):1-32.
- Uzoka, F. and Seleka, G., 2006. B2C E-Commerce Development in Africa: Case Study of Botswana. *Proceedings of the 7th ACM conference on Electronic commerce*, ACM, 11-15 June 2006, Ann Arbor, Michigan, USA, pages 290-295.
- Vakentesh, S. and Massingue, C., 2003. "Building awareness and supporting African universities in ICT management," *Doctoral Dissertation*, Delft University of Technology, Netherlands.
- Van Belle, J.P. and Ellis, J., 2009. "Open source software acceptance by South Africans MSEs: Barriers and Enablers". *Proceedings of the 2009 Annual Conference of the Southern African*

Computer Lecturers Association, ACM, 29-1 July 2009, Eastern Cape, South Africa, pages 41-50.

Venkatesh, V., 2000. "Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model", *Information Systems Research*, INFORMS, Linthicum, Maryland, USA 11(4):342-365.

Venkatesh, V. and Bala, H., 2008. "Technology Acceptance Model 3 and a research agenda on interventions" *Decision Sciences*, Wiley Online Library, Hoboken, New Jersey, USA, 39(2):273-315.

Venkatesh, V. and Davis, F.D., 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science*, INFORMS, Linthicum, Maryland, USA, 46(2):186-204.

Venkatesh, V., Morris, M.G., Davis, F.D. and Davis, G.B., 2003. "User Acceptance of Information Technology: Toward a Unified View", *MIS Quarterly*, Management Information System Research Center, University of Minnesota, Minnesota, USA, 27(3):425-478.

Verdegem, P. and Marez, L., 2011, "Rethinking determinants of ICT acceptance: Towards an integrated and comprehensive overview", *Technovation*, Elsevier, Amsterdam, The Netherlands, 31(8):411-423.

Verdegem, P. and Marez, L.D., 2008. "Conditions for technology acceptance; Broadening the scope of determinants of ICT appropriation". *Proceedings of the International conference on e-Business*, INSTICC Press, 26-29 July 2008, Porto, Portugal, pages 292-299.

Verdegem, P. and Verhoest, P., 2008. "The relative utility approach for stimulating ICT acceptance: Profiling the non-user". *Proceedings of the IADIS International Conference e-Society 2008*, 9-12 April 2008, Algarve, Portugal, pages 154-161.

Wagner, C., 2004. "wiki: a technology for conservational knowledge management and group collaboration". *Communications of the association for Information Systems*, Association for Information Systems, USA, 13(1):265-289.

- Walsham, G. and Sahay, S., 2006. "Research on information systems in developing countries Current Landscape and future prospects", *Journal for Information Technology for Development*, IOS Press, Amsterdam, The Netherlands, 12 (1):7-24.
- Waugh, J., 2008. "The Australian Open Source Industry & Community Report 2008", Waugh Partners, available at <<http://census.waughpartners.com.au/census-report-2008-r1.pdf>> [Accessed 5 March 2011].
- Weber, S., 2000. "The political economy of open source software". *The International Journal of Technology, Knowledge and Society*, SAGE Publications, Thousand Oaks, California, 1(7):127-134.
- Weber, S., 2004. "Open Source Software in developing economies", University of California, Berkeley, USA, available at <<http://mediaresearchhub.ssrc.org/open-source-software-in-developing-economies/attachment>> [Accessed 12 April 2011].
- Webster Dictionary, 2011. "Software", available at < <http://www.webster-dictionary.org/definition/software> > [Accessed 25 October 2011].
- Word Bank, 2011. "World Bank Search", available at < <http://search.worldbank.org/>> [Accessed 25 November 2011].
- Whitehead, L.T., 2005. "Basic classical Ethnographic Research Methods", Cultural Ecology of Health and Change, Ethnographically Informed Community and Cultural Assessment Research Systems (EICCARS) Working Paper Series, University of Maryland, Maryland, USA available at < <http://www.cusag.umd.edu/documents/WorkingPapers/ClassicalEthnoMethods.pdf> > [Accessed 27 March 2011].
- Wolcott, H. F., 1995. "The Art of Fieldwork", AltaMira, Walnut Creek, California, USA.
- Xakaza, S., 2006. "Using the internet communications tools to facilitate learning", *2010 International Conference, Education and Management Technology (ICEMT)*, 2-4 November 2010, Cairo, Egypt, pages 706-710.

Yin, R. 1994. "Case study research: Design and methods (2nd ed.)", Sage Publishing, Beverly Hills, California, USA.

Zhang, P., 2007. "Roles of attitudes in initial and continued ICT use: A longitudinal study". *AMCIS proceedings, 10-12 August 2007, Keystone, Colorado, USA, pages 1-7.*

Zini, E. and Lin, Y., 2006. "Free/libre open source software implementation in schools: Evidence from the field and implications for the future", *Journal in Computers and Education*, Elsevier, Oxford, UK, 50(3):1092-1102.

Appendix 1 Ethical clearance approval



Mr J Kinyondo (45935696)
School of Computing (Student)
UNISA
Pretoria

5 April 2011

Permission to conduct MSC (IS) research project

Ref: 011/JK/2011

The request for ethical approval for your MSc (IS) research project entitled "Does the promotion of open source in Tanzania address the ICT acceptance challenges?" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:

http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that if you subsequently do a follow-up study that requires the use of a ~~different research~~ instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Prof JH Kroeze
Chair: School of Computing Ethics Sub-Committee



University of South Africa
College of Science, Engineering and Technology
Pretorius Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 6122 Facsimile +27 12 429 6848
www.unisa.ac.za/cset

Appendix 2: Questionnaire on open source

UNIVERSITY OF SOUTH AFRICA

QUESTIONNAIRE ON OPEN SOURCE PROMOTION IN TANZANIA

BACKGROUND:

Below are demographic questions of which the appropriate answer is selected by marking an X on the provided box

1. Age:

| | | | | | | | |
|-------|--|-------|--|-------|--|----------|--|
| 20–30 | | 30–40 | | 40–50 | | Above 50 | |
|-------|--|-------|--|-------|--|----------|--|

2. Gender

| | | | |
|------|--|--------|--|
| Male | | Female | |
|------|--|--------|--|

3. Occupation:

4. IT Experience: _____

| | |
|-----------------------------|--|
| IT professional | |
| System analyst | |
| Computer technician | |
| End User | |
| Other IT related experience | |

5. IT experience (number of years)

6. List and describe the perceived ICT acceptance challenges in Tanzania.

7a. List and describe the advantages of open source in Tanzania.

7b. List and describe the disadvantages of open source in Tanzania.

OPEN SOURCE PROMOTION EFFORTS

The following are used to promote OS. Please indicate how important you find each of the following in promoting the acceptance of OS in Tanzania by making a cross 'X' over the most appropriate answer.

8. Establishment of OS communities

| | | | | |
|---------------------|-------------|-----------------------|-----------|----------------|
| Totally unimportant | Unimportant | Neither important nor | Important | Very important |
|---------------------|-------------|-----------------------|-----------|----------------|

9. Implementation of online discussion forums?

| | | | | |
|---------------------|-------------|-----------------------|-----------|----------------|
| Totally unimportant | Unimportant | Neither important nor | Important | Very important |
|---------------------|-------------|-----------------------|-----------|----------------|

10. Free software distribution

| | | | | |
|---------------------|-------------|-----------------------|-----------|----------------|
| Totally unimportant | Unimportant | Neither important nor | Important | Very important |
|---------------------|-------------|-----------------------|-----------|----------------|

11. Seminars and workshops on OS

| | | | | |
|---------------------|-------------|-----------------------|-----------|----------------|
| Totally unimportant | Unimportant | Neither important nor | Important | Very important |
|---------------------|-------------|-----------------------|-----------|----------------|

12. Campaign for OS policies

| | | | | |
|---------------------|-------------|-----------------------|-----------|----------------|
| Totally unimportant | Unimportant | Neither important nor | Important | Very important |
|---------------------|-------------|-----------------------|-----------|----------------|

13. Academic education about OS applications

| | | | | |
|---------------------|-------------|-----------------------|-----------|----------------|
| Totally unimportant | Unimportant | Neither important nor | Important | Very important |
|---------------------|-------------|-----------------------|-----------|----------------|

What other open source promotional efforts done in Tanzania that you are aware of?

PROMOTIONAL EFFORTS AND ICT CHALLENGES:

VENDOR DEPENDENCY

Vendor dependency in OS communities:

14. Are you a member of an existing open source community in Tanzania?

| | | | |
|-----|--|----|--|
| YES | | NO | |
|-----|--|----|--|

15. How many open source communities in Tanzania are you aware of?

| | | | | | |
|------------------|--|-------------------|--|--------------|--|
| Between 1 and 10 | | Between 10 and 20 | | More than 20 | |
|------------------|--|-------------------|--|--------------|--|

16. How many active members are there on average in each community?

| | | | | | |
|------------------|--|-------------------|--|--------------|--|
| Between 1 and 10 | | Between 10 and 20 | | More than 20 | |
|------------------|--|-------------------|--|--------------|--|

17. Can an organisation rely on IT solutions that might be offered by the open source community?

| | | | | | | | | | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|
| Strongly disagree | | Disagree | | Neutral | | Agree | | Strongly Agree | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|

SKILLS:

18 How would you rate the average IT skills of member per community?

| | | | | | | | | | |
|----------|--|-----|--|----------|--|--------|--|-----------|--|
| Very low | | Low | | Moderate | | Higher | | Very high | |
|----------|--|-----|--|----------|--|--------|--|-----------|--|

19. What is the level of online project contribution of the members in the online community public discussions?

| | | | | | | | | | |
|----------|--|-----|--|----------|--|--------|--|-----------|--|
| Very low | | Low | | Moderate | | Higher | | Very high | |
|----------|--|-----|--|----------|--|--------|--|-----------|--|

20. What type of IT skills do you think are mostly addressed under various topics posted by members on open source community online forums? Please prioritise by placing a number on an empty line: 1 being the highest value and 5 the lowest

| | |
|--------------------------|--|
| Computer literacy | |
| Computer programming | |
| Computer troubleshooting | |
| Data handling | |
| Basic IT knowledge | |

OS AWARENESS

21. How many other external partners does the open source community you belong to have?

| | | | | | |
|-----------------|--|------------------|--|--------------|--|
| Between 1 and 5 | | Between 5 and 10 | | More than 10 | |
|-----------------|--|------------------|--|--------------|--|

22. How many events (seminars, workshops or meetings) have your open source community conducted annually?

| | | | | | |
|-----------------|--|------------------|--|--------------|--|
| Between 1 and 5 | | Between 5 and 10 | | More than 10 | |
|-----------------|--|------------------|--|--------------|--|

| | | | | | | | | | |
|----------|--|-----|--|----------|--|--------|--|-----------|--|
| Very low | | Low | | Moderate | | Higher | | Very high | |
|----------|--|-----|--|----------|--|--------|--|-----------|--|

23. How would you rate the level of success of seminars conducted for the public?

COST

Open source movements are widely known in their efforts to offer free and downloadable software. Do these efforts address the following?

24. Product purchase cost?

| | | | | | | | | | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|
| Strongly disagree | | Disagree | | Neutral | | Agree | | Strongly agree | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|

25. Product licensing cost?

| | | | | | | | | | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|
| Strongly disagree | | Disagree | | Neutral | | Agree | | Strongly agree | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|

26. Product maintenance cost?

| | | | | | | | | | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|
| Strongly disagree | | Disagree | | Neutral | | Agree | | Strongly agree | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|

27. Product distribution cost?

| | | | | | | | | | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|
| Strongly disagree | | Disagree | | Neutral | | Agree | | Strongly agree | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|

| | | | | | | | | | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|
| Strongly disagree | | Disagree | | Neutral | | Agree | | Strongly agree | |
|-------------------|--|----------|--|---------|--|-------|--|----------------|--|

28. Product training cost?

GOVERNMENT AND PRIVATE SECTOR SUPPORT

29. How many private sector companies have partnered in your open source movements?

| | | | | | |
|-----------------|--|------------------|--|--------------|--|
| Between 1 and 5 | | Between 5 and 10 | | More than 10 | |
|-----------------|--|------------------|--|--------------|--|

30. How many government institutions have partnered with your community in its open source movements?

| | | | | | |
|-----------------|--|------------------|--|--------------|--|
| Between 1 and 5 | | Between 5 and 10 | | More than 10 | |
|-----------------|--|------------------|--|--------------|--|

31. What level of assistance is given by the government to the open source community?

| | |
|------------------|--|
| None | |
| Very limited | |
| Limited | |
| Substantial | |
| Very substantial | |

32. What level of assistance is provided by private institutions in the open source community?

| | |
|------------------|--|
| None | |
| Very limited | |
| Limited | |
| Substantial | |
| Very substantial | |

33. Besides open source promotional efforts mentioned previously, what other efforts can be used to address common ICT acceptance challenges in Tanzania?

Appendix 3 Interview questions

1. What is the core business of your company?
2. What are the roles of the IT department in your company?
3. What software solutions do you use for each major role of your company? Please explain why
4. Are you aware of any open source solutions that perform the same task as the software you are using? Please mention them.
5. Would you recommend the usage of these open source solutions in your company?
6. If the answer to above question is NO, what do you think can be done to change your mind?
7. Are you aware of any open source promotional efforts done by various open source communities in Tanzania? How would you rate their importance?
8. If the answer to above question is YES, do you think the promotional efforts address the ICT acceptance challenges in Tanzania? Mention these challenges.
9. What do you see as the general advantages of OS in Tanzania?
10. What do you see as the general disadvantages of OS in Tanzania?
11. How can OS be effectively promoted in Tanzania?

Appendix 4: Quantitative data captured in response to the survey

| QUESTIONNAIRE RESPONSE | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|-----------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Respondent # | QUESTION NUMBER | | | | | | | | | | | | | | | | | | | | | | | |
| | Q5 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Q15 | Q16 | Q17 | Q18 | Q19 | Q21 | Q22 | Q23 | Q24 | Q25 | Q26 | Q27 | Q28 | Q29 | Q30 | Q31 | Q32 |
| 1 | 14 | 5 | 5 | 4 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | 2 | 2 | 1 | 3 | 5 | 5 | 4 | 4 | 4 | 3 | 1 | 2 | 4 |
| 2 | 19 | 5 | 5 | 5 | 5 | 5 | 4 | 1 | 2 | 5 | 3 | 2 | 3 | 1 | 1 | 5 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 3 | 22 | 5 | 4 | 5 | 5 | 4 | 5 | 1 | 1 | 4 | 2 | 1 | 3 | 1 | 3 | 4 | 5 | 5 | 5 | 4 | 1 | 1 | 2 | 4 |
| 4 | 14 | 4 | 5 | 4 | 5 | 5 | 4 | 1 | 2 | 3 | 3 | 3 | 1 | 1 | 2 | 5 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 5 | 15 | 4 | 5 | 5 | 5 | 5 | 4 | 2 | 2 | 4 | 3 | 1 | 3 | 1 | 2 | 4 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 6 | 19 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 3 | 4 | 3 | 1 | 3 | 1 | 1 | 5 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 7 | 18 | 4 | 4 | 5 | 4 | 5 | 4 | 1 | 2 | 2 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 5 | 4 | 4 | 3 | 1 | 2 | 4 |
| 8 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 4 | 1 | 1 | 2 | 4 |
| 9 | 11 | 5 | 5 | 5 | 4 | 4 | 5 | 1 | 2 | 4 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 4 | 5 | 5 | 3 | 1 | 2 | 4 |
| 10 | 8 | 5 | 5 | 5 | 4 | 5 | 5 | 1 | 2 | 4 | 2 | 2 | 3 | | 3 | 5 | 5 | 4 | 5 | 5 | 3 | 1 | 2 | 4 |
| 11 | 20 | 5 | 5 | 4 | 5 | 5 | 5 | 1 | 3 | 4 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 4 | 2 | 1 | 2 | 4 |
| 12 | 17 | 5 | 5 | 5 | 4 | 5 | 4 | 1 | 2 | 4 | 3 | 2 | 1 | 1 | 2 | 4 | 5 | 5 | 5 | 4 | 3 | 1 | 2 | 4 |
| 13 | 19 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 2 | 2 | 1 | 3 | 1 | 3 | 5 | 5 | 2 | 4 | 4 | 3 | 1 | 2 | 4 |
| 14 | 16 | 4 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 5 | 2 | 1 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 15 | 25 | 5 | 4 | 4 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 3 | 5 | 4 | 1 | 1 | 2 | 4 |
| 16 | 14 | 5 | 4 | 5 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | | 3 | 1 | 4 | 4 | 5 | 5 | 5 | 4 | 1 | 1 | 2 | 4 |
| 17 | 18 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 3 | 4 | 3 | 2 | 3 | 1 | 3 | 5 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 18 | 16 | 5 | 5 | 5 | 4 | 5 | 4 | 1 | 2 | 4 | 3 | 2 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 4 | 3 | 1 | 2 | 4 |
| 19 | 7 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 4 | 2 | 2 | 3 | 1 | | 5 | 5 | 2 | 5 | 4 | 3 | 1 | 2 | 4 |
| 20 | 20 | 5 | 4 | 5 | 5 | 4 | 4 | 1 | 1 | 2 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 4 | 3 | 1 | 2 | 4 |
| 21 | 19 | 5 | 5 | 5 | 4 | 5 | 5 | 2 | 2 | 4 | | 1 | 1 | 1 | 3 | 5 | 5 | 4 | 5 | 2 | 3 | 1 | 2 | 4 |
| 22 | 13 | 5 | 5 | 5 | 5 | 4 | 4 | 1 | 3 | 4 | 3 | 1 | 1 | 1 | 3 | 5 | 5 | 5 | 4 | 4 | 3 | 1 | 2 | 4 |
| 23 | 18 | 5 | 4 | 4 | 4 | 5 | 4 | 1 | 2 | 4 | 3 | 2 | 2 | | 3 | 5 | 5 | 5 | 4 | 4 | 3 | 1 | 2 | 4 |
| 24 | 15 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 2 | 3 | 3 | 1 | 3 | 1 | 3 | 5 | 5 | 5 | 4 | 4 | 3 | 1 | 2 | 4 |
| 25 | 17 | 4 | 4 | 4 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 4 | 5 | 2 | 1 | 1 | 2 | 4 |
| 26 | 8 | 5 | 5 | 5 | 5 | 4 | 5 | 1 | 2 | 4 | 2 | 3 | 3 | | 2 | 5 | 5 | 2 | 5 | 2 | 3 | 1 | 2 | 4 |
| 27 | 11 | 5 | 5 | 4 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | 2 | 3 | 1 | 2 | 5 | 5 | 4 | 5 | 4 | 3 | 1 | 2 | 4 |
| 28 | 21 | 5 | 5 | 5 | 4 | 5 | 5 | 1 | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 5 | 5 | 4 | 5 | 4 | 3 | 1 | 2 | 4 |
| 29 | 19 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 5 | 2 | 2 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 5 | 3 | 1 | 2 | 4 |
| 30 | 11 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 5 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 2 | 5 | 4 | 3 | 1 | 2 | 4 |
| 31 | 13 | 5 | 5 | 4 | 5 | 5 | 4 | 1 | 2 | 4 | 3 | 1 | 3 | 1 | 3 | 5 | 5 | 4 | 5 | 2 | 3 | 1 | 2 | 4 |
| 32 | 3 | 4 | 5 | 5 | 5 | 5 | 4 | 1 | 1 | 4 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 5 | 5 | 4 | 3 | 1 | 2 | 4 |
| 33 | 12 | 5 | 5 | 5 | 5 | 4 | 4 | 1 | 2 | 4 | | | 3 | | 4 | 5 | 5 | 5 | 5 | 2 | 2 | 1 | 2 | 4 |
| 34 | 16 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 2 | 5 | 3 | 2 | 3 | 1 | 2 | 5 | 5 | 2 | 5 | 4 | 3 | 1 | 2 | 4 |
| 35 | 14 | 5 | 4 | | 5 | 5 | 5 | 2 | 1 | 3 | 3 | 2 | 1 | 1 | 2 | 5 | 5 | 5 | 5 | 4 | 3 | 1 | 2 | 4 |
| 36 | 17 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 3 | 4 | 3 | | 3 | 1 | 3 | 5 | 5 | 5 | 5 | 2 | 3 | 1 | 2 | 4 |
| 37 | 24 | 4 | 5 | 4 | | 5 | 5 | 1 | 2 | 4 | 3 | 1 | 3 | 1 | 3 | 5 | 5 | 4 | 5 | 4 | 3 | 1 | 2 | 4 |
| 38 | 16 | 5 | 5 | 4 | 4 | 5 | 5 | 1 | 3 | 4 | 2 | 1 | 3 | 1 | 2 | 5 | 5 | 2 | 5 | 2 | 3 | 1 | 2 | 4 |
| 39 | 21 | 5 | 5 | 5 | 5 | 5 | 4 | 1 | 2 | 3 | 3 | 1 | 3 | 1 | 2 | 5 | 5 | 4 | 5 | 2 | 3 | 1 | 2 | 4 |
| 40 | 9 | 5 | 5 | 5 | 4 | 5 | 4 | 1 | 2 | 4 | 2 | 1 | 3 | 1 | 3 | 5 | 5 | 4 | 5 | 5 | 3 | 1 | 2 | 4 |

Title of thesis:

**AN ASSESSMENT OF OPEN SOURCE PROMOTION IN ADDRESSING ICT
ACCEPTANCE CHALLENGES IN TANZANIA**

Summary

Developing countries like Tanzania experience challenges towards utilization and acceptance of ICT; calling for a need to further research on the concept. Open Source (OS) usage is a potential strategy for addressing such challenges. However, the success of this strategy strongly relies on the strength of the promotional efforts. The study, therefore aims at assessing the OS promotional efforts in relation to ICT acceptance challenges in Tanzania.

The study had three objectives; the first pertained to the identification of ICT acceptance challenges in Tanzania. Advantages of OS such as free distribution and transferability were listed as factors that could positively influence ICT acceptance. The second objective examined OS promotional activities in Tanzania while the third objective evaluated these activities in the light of ICT acceptance challenges. Despite the positive impact of OS promotion, ICT acceptance challenges have not been successfully addressed given the weaknesses identified in the promotional activities

Key terms:

ICT, Open Source, ICT acceptance, Developing Countries, Tanzania, Technology Acceptance Models, Promotion, ICT challenges, Open Source Community, Technology.