Developing a Framework for Open Source Software Adoption in a Higher Education Institution in Uganda.

A case of KIU

A thesis

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Master of Science in Systems Software engineering

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DECLARATION A

This thesis is my original work and has not been presented for a Degree or any other academic award in any University or Institution of Learning".

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DECLARATION B

I, confirm that the work reported in this thesis was carried out by the candidate under my supervision".

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24/10/2012

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APPROVAL SHEET

This thesis entitled "Developing a framework for open source software adoption in a higher education institution in Uganda. The case of Kampala International University" prepared and submitted by MAGANDA EVANS TABINGWA in partial fulfillment of the requirements for the degree of Master of Science in Systems Software engineering has been examined and approved by the panel on oral examination with a grade of PASSED.

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DEDICATION

I, dedicate this research to my darling wife Mary N. Maganda and my dear son Darrel Hans Maganda Jr. for the source of comfort they have given me during this research. To my father and mother for their seed of life and emotional guidance.

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ABSTRACT

This study aimed at developing a frame work for open source software adoption in an institution of higher learning in Uganda with the case of KIU as a study area. There were mainly four research questions based on; individual staff interaction with open source software forum, perceived FOSS characteristics, organizational characteristics and external characteristics as factors that affect open source software adoption. The researcher used causal-correlation research design to study effects of these variables on open source software adoption. A quantitative approach was used in this study with self administered questionnaire on a purposively and randomly sampled sample of university ICT staff. Resultant data was analyzed using means, correlation coefficients and multivariate multiple regression analysis as statistical tools. The study reveals that individual staff interaction with open source software forum and perceived FOSS characteristics were the primary factors that significantly affect FOSS adoption while organizational and external factors were secondary with no significant effect but significant correlation to open source software adoption. It was concluded that for effective open source software adoption to occur there must be more effort on primary factors with subsequent reinforcement of secondary factors to fulfill the primary factors and adoption of open source software. Lastly recommendations were made in line with conclusions for coming up with Maganda frame work for open source software adoption in institutions of higher learning. Areas of further research recommended include; Stakeholders' analysis of open source software adoption in Uganda; Challenges and way forward. Evaluation of Maganda frame work for open source software adoption in institutions of higher learning. Framework development for cloud computing adoption in Ugandan universities. Framework for FOSS development in Uganda IT industry.

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LIST OF ACRONYMS

KIU	Kampala International University
FOSS/OSS	Free Open Source Software/Open Source Software
ANOVA	ANalysis Of Variance
SPSS	Stastical Package for Social Sciences
ICT	Information Communication Technology
WAMP	Windows Apache MySQL and PHP/Python/Pearl
XAMPP	Cross platform Apache, MySQL, PHP+PEARL
MDGs	Millenium Development Goals
EACOS	East African Center for Open source Software
UNSD	United Nations Statistics Division
USA	United States of America
VB.NET/VB	Visual Basic.NET/Visual Basic
FOSSFA	Free Software and Open Source Foundation for Africa
HOD	Head Of Department

CHAPTER ONE

THE PROBLEM AND ITS SCOPE

Background of the Study

The software technology has always been an important component of modern development tool especially in the world of business, academia and general community development. Time over, the software technology development has been aimed to solve business/community problems with solutions that provide effective, efficient and timely answers to these problems. Software technology simply makes man's work easier. Businesses world over have employed use of software packages and more so computerized information systems to aid their business operations in a way that satisfies their clients with faster and effective service delivery. Distributed software on the market that solve all these problems, could either be proprietary or open source. According to Wheeler (2007), Proprietary software refers to computer programs that are exclusive property of their developers or publishers, and cannot be copied or distributed without complying with their licensing agreements. Almost all commercial (shrink-wrapped) software are proprietary, but many excellent new programs (such as Apache web server, Linux operating system, and StarOffice office suite) are non-proprietary. Open source software on the other hand refers to programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (Wheeler, 2007).

Wheeler (2007), still comments that open source software adoption comes with a lot of advantages ranging from reliability, performance, scalability,

Otherwise the whole industry in Uganda was reported to be dominated by proprietary software companies.

Statement of the problem

Efforts by open source champion institutions in Uganda have mainly focused on advocating for open source software adoption without a clear focused strategy on institution of higher learning to create critical mass for OSS adoption. Open source software engineers have put much of their energy on production of software that are freely replicable with assumptions that people will adopt cheaper and freely distributable software compared to proprietary software. According to Eugine etal (2010) Open source software has attracted a great deal of commercial interest since the term was introduced in 1998. However, most of the research to date on OSS has focused on the motivations of individual developers who contribute to OSS projects or has concentrated on specific OSS products and projects. Given the many complex and novel issues that surround use of OSS in institutions of higher learning in Uganda, the process of OSS adoption is not well understood in majority institutions of higher learning. Out of 29 universities in Uganda only three (Uganda martyrs university-Nkozi, Bugema university and University of Health Sciences-Uganda have considerably gone open source), with EACOS being the only technical private OSS training institution in Uganda. According to a research study done by Wabule (2007), this researcher recommended open source software adoption as the most appropriate option visa vie proprietary software use in Uganda. Also according to millennium development goal fulfillment strategy-2015 of Uganda, MDG goal 8 of developing a global partnership for development, target 18, emphasizes the government commitment to cooperate with the private sector so as to make available the benefits of new technologies, especially information

and communications (United Nations Statistics Division, 2007). Open source software adoption should definitely be part of this strategy bearing high costs of proprietary software in our market but more so because of the increasing opportunities of developing localized Ugandan software applications to address local needs. This is also more feasible today bearing the increased access to mobile phones, personal computers and mobile applets. There was therefore need, to come up with multi dimensional frame work for effective open source software adoption in these institutions.

Purpose of the study

To develop a framework for open source software adoption for KIU in Uganda.

General objective

To design a framework for open source software adoption for KIU, based on level of individual interaction with open source software forums, perceived open source software, organizational and external characteristics of the institution.

Specific research objectives

(i) To determine the profile of the respondents in terms of age, gender, position, education level, education specialization, possession of any other ICT professional qualifications, existing and future professional ICT enrollment.

(ii) To investigate how lecturers/ICT staff level of interaction with open software forums affect open source software adoption.

(iii) To establish the influence of perceived open source software attributes on open source software adoption.

(iv) To establish significant relationship between organizational attributes and open source software adoption.

(v) To investigate the extent to which external factors affect open source software adoption.

(vi) To design a frame work for open source software for KIU

Research questions

(i) Does the staff level of interaction with open source software forums significantly affect open source software adoption?

(ii) Do perceived open source software characteristics by staff significantly affect open source software adoption levels?

(iii) Do the organizational characteristics of an institution significantly affect open source software adoption levels among staff?

(iv) Of what influence do external factors have on open source software adoption among staff?

(v) How can a framework for effective open source software adoption among staff be developed in KIU?

Hypotheses

The following hypotheses were validated in this study;

1st Null Hypothesis: The level of Individual knowledge/interaction of KIU staff with source software forums/tools

	has no significant influence on open source software adoption.
2nd Null Hypothesis:	The open source software characteristics perceived by KIU staff have no significant influence on open source software adoption.
3rd Null Hypothesis:	KIU organizational characteristics have no significant influence on open source software adoption.
4th Null Hypothesis:	External characteristics that are software related have no significant influence on open source software adoption in KIU.

Scope of the study

Geographically, the study covered Kampala International University main campus staff in different departments directly affected by significant usage of ICT, among which included; College of applied sciences and technology (both at undergraduate and postgraduate level), ICT department (both at administrative and computer lab usage levels), students' results processing department, School of professional studies, students' admission department. Theoretically, this research basically involved Roger's innovation adoption theory which includes 'the innovation-decision process, innovation characteristics, adopter characteristics, and opinion leadership'. Rogers' theory can be divided into three main components: (1)The innovation-decision process (2)The characteristics of an innovation, and (3)Adopter characteristics. This study took a period of 10 months from January 2012 till October 2012. In content, this research looked at how staff level of interaction with open source software forums, open source software perceived characteristics,

organizational characteristics and external factors affected open source software adoption among staff in an institution of higher learning.

Significance of the study

This study looked into how staff level of interaction with open source software forums, perceived characteristics of open source software, organizational characteristics of institution and external factors that affected open source software adoption among staff in the University.

(i) In the field of research, new knowledge on creation of a maganda framework for open source software adoption in an institution of higher learning with a view of promoting its adoption among ICT staff was developed.

(ii)This study is of help to open source software promoters in Uganda to engage in effective open source software adoption strategy among staff in institutions of higher learning.

(iii) This study is to increase level of software innovations among ICT staff in institutions of higher through provision of alternative productive solutions to existing software problems.

(iv)This study is to help both members of staff and institutions of higher learning to improve their ethical standards in software usage by reducing software piracy which is at the door of almost every user of proprietary software.

(v)To develop critical mass of open source software developers/users institutions of higher learning in Uganda.

(v)This study is going to make a significant contribution to the Uganda government strategy on millennium development goal 8: target 18; which emphasizes the commitment to cooperate with the private sector so as to make available the benefits of new technologies, especially information and communications.

Operational definitions of key terms

Open source software (FOSS)

This are computer software with certain other rights normally reserved for copyright holders provided under an open source license that permits users to study, change, improve and at times also redistribute the software.

Proprietary software

These are software that are exclusive property of their developers, and cannot be copied or distributed without complying with their licensing agreements unless illegally stolen or pirated.

Maganda Frame work of open source software adoption

Refers to the broad overview, outline, or skeleton of interlinked factors of individual level of interaction with open source software forums, perceived open source software characteristics by staff, organizational characteristics of institution and external characteristics and how they combine based on their strength on FOSS adoption and in line with objective of study together together with Rogers paradigm of the innovation-

decision process to serve as a guide that can be modified as required by adding or deleting these components.

Open source software adoption

Refers to staff actual use of open source software either in terms of ability or frequency of use.

Open source software forums

This refers to either online or offline open source software change agents who are either involved in FOSS development or FOSS advocacy.

Preferred perceived open source software characteristics

Refers to open source software characteristics that the ICT staff consider advantageous or important to them.

Non preferred perceived open source software characteristics

Refers to open source software characteristics that ICT staff consider disadvantageous or not important to them.

Organizational characteristics

This refers to organizational factors that either promote or hinder open source software absorption.

External characteristics/factors

This refers to other external factors that either hinder or promote open source software adoption.

Causal-correlation study

Refers to a research design that aims at establishing whether factors under study affect open source software adoption or are correlated to it.

Higher education institution

Refers to a tertiary institution of learning that offers diplomas and degrees.

CHAPTER TWO

REVIEW OF RELATED LITRATURE

Introduction

This chapter covers concepts, opinions, ideas, from authors and experts; it looks into theoretical perspective of this study and various related studies that helped the researcher appreciate various dimensions of this research.

Concepts, opinions, ideas, from authors/experts

Information communication technology has become a very important component of modern society. It spans right from government, institutions of learning, companies, non-governmental organizations just a few to mention. In Uganda's strategy to meet the millennium development goal 8 by 2015, it has put a target 18 that emphasizes the government commitment to cooperate with the private sector so as to make available the benefits of new technologies, especially information and communications (United Nations Statistics Division, 2007). ICT consists of both hardware and software technology to fulfill the communication.

This study in particular was interested in the software part of this technology. A software is defined in general terms as various kinds of programs used to operate computers and related devices (Rouse, 2012). Software could be broadly categorized into system and application software, where system software help in overall functionality of making the computer hardware work and application software consisting of those that have been developed to solve various human being tasks like office

work, database systems, computer automated designs, e-learning systems, websites. Software are developed by companies or individuals and are distributed with a license that either restricts their use to license terms of the developer or they may be unrestricted with an available source code that could be redistributed, modified or changed. Software distributed with restrictive license are called proprietary software and those with limited or no restriction are called open source software. This software could be broadly grouped into various applications; office software, database, programming software, web based software, e-learning and many more application formats depending ones interest.

This study in particular was interested in open source software adoption over proprietary on basis of its numerous advantages to our poor economy. Some of the notable advantages of open source software include; Reliability, Stability, Auditability, Cost, Flexibility and Freedom, Support and Accountability but according to (bwire, 20009), the advantaes of open source over proprietary can't be a clear cross cut, instead they can joint be discussed under cost, service and support, innovation, usability, and security. The researcher in this regard agrees with bwire, because there are quite a number of factors that dictate whether an advantage of open source software to one individual is a disadvantage to another person in a different environment.

Open source software verses proprietary software

According to bwire (2009), open source software is defined as software distributed under a licensing agreement which allows the source code (computer code) to be shared, viewed and modified by other users and organizations while a proprietary software is defined as software

distributed under a licensing agreement to authorized users with private modification, copying and republishing restrictions. For this matter the advantages and disadvantages of open source software verses proprietary software are discussed as follows;

Cost

Proprietary software have a one bundled fee for its software which makes it relatively expensive than proprietary software. This one stand fee includes; technical support, continous innovations, customized product from a trusted brand. Open source software is cheaper on the other hand because its licence is cheap compared to proprietary software, innovation is at user level and not at producer level, however the user relies on online community support which is voluntary and not reliable, reliable internet connections are a must requirement, and a lot of skills set required to customize open source software. So if internet services are available and skills set for open source software are in place or training is done, then open source software is best option for minimum cost.

Service and Support

This could be termed to be the key selling point for proprietary software especially if an organization has limited technical staff. If Internet is readily available then more than enough support is found online and on software blogs, the only disservice is that prompt responses can't be guaranteed. Therefore if an organization has sufficient technical staff and reliable Internet then open source software is way to go but otherwise proprietary.

Innovation

Open source software allows innovation by providing users freedom and flexibility to adapt the software to suit without restrictions but its users prerogative whether they want to adopt and must be very active participants in online communities to be aware of such innovations. In business sense, proprietary software makes innovation sense because a software comes fully tested and customized to carry specific function and online community also exists to help when need arises.

Usability

Open source software is developer centric with limited documentation such as manuals and guides and the technology is not usually reviewed by usability experts. Proprietary software on the other hand employs usability experts therefore proving user friendly manuals easy to follow.

Security

Proprietary software according to bwire is more secure because it's alleged to be developed under controlled environment in a common direction with permitted experts in development team to view the code, while open source software is viewed less secure because much as access of source code is free the user may not have sufficient technical expertise to guard against intrusion. However from the researchers' point of view this contradicts high level of software piracy in proprietary than open source software.

Based on discussion of these factors its very evident that if Internet services are reliable, open source software expertise is high in an institution and level of interaction of individuals in an institution with open

source software forums is high then open source stands scores high on factors explained by bwire (2009).

Individual level of interaction with open source software forums

Characteristics of an individual may make the individual be ready or not ready to adopt a particular technology. Among these characteristics include; level of education, age, level of training, level of interactivity with change agents, age gender and income status (Bakabulindi, 2007). Bakabulindi notes that many studies have been done on individual characteristics which give contradicting results which could either be attributed to research methodologies used, operationalization of variables or computational errors. This means that for every new study done in a different environment or field with varying methodology then different results are always very possible from that study in comparison to previous studies done. Bearing in mind that open source software is not entirely new technology but is complementing proprietary software then major variation of this study on individual characteristics were operationalised on individual levels of interacting with open source software forums as common change agents.

Perceived open source software characteristics

According to Rogers (2003), there are five major factors affecting the rate of adoption:

Perceived Attributes of Innovation

An innovation is a idea, practice or object that is perceived as new by an individual or other unit of adoption. How the adopter perceived characteristics of the innovation has impacts on the process of adoption.

Relative advantage:

The degree to which an innovation is perceived as better than the idea it supersedes. The underlying principle is that the greater the perceived relative advantage of an innovation, the more raid its rate of adoption

Compatibility:

The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters

Complexity:

The degree to which an innovation is perceived as difficult to understand and use

Trialability:

The degree to which an innovation may be experimented with on a limited basis. If an innovation is trialability, it results in less uncertainty for adoption

Observability:

The degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt.

Organizational and external characteristics

According to business dictionary (2012), an organization is defined as social unit of people, systematically structured and managed to meet a need or to pursue collective goals on a continuing basis. All organizations

have a management structure that determines relationships between functions and positions, and subdivides and delegates roles, responsibilities, and authority to carry out defined tasks. Organizations are open systems in that they affect and are affected by the environment beyond their boundaries. From discussions already done, bwire(2009) argues that organizations are very important component of software adoption, because much as proprietary and open source software may complement one another but choice of one over the other lies in nature of organization and level of software expertise among individuals. According to rogers(2003),factors that affect adoption of innovation in an organization hand on individual characteristics, nature of organization in terms of decision support to that innovation, external characteristics of that organization in relation to interactivity with other organizations.

Theoretical framework

This framework looked at various theories related to the study and the conceptual framework of the study.

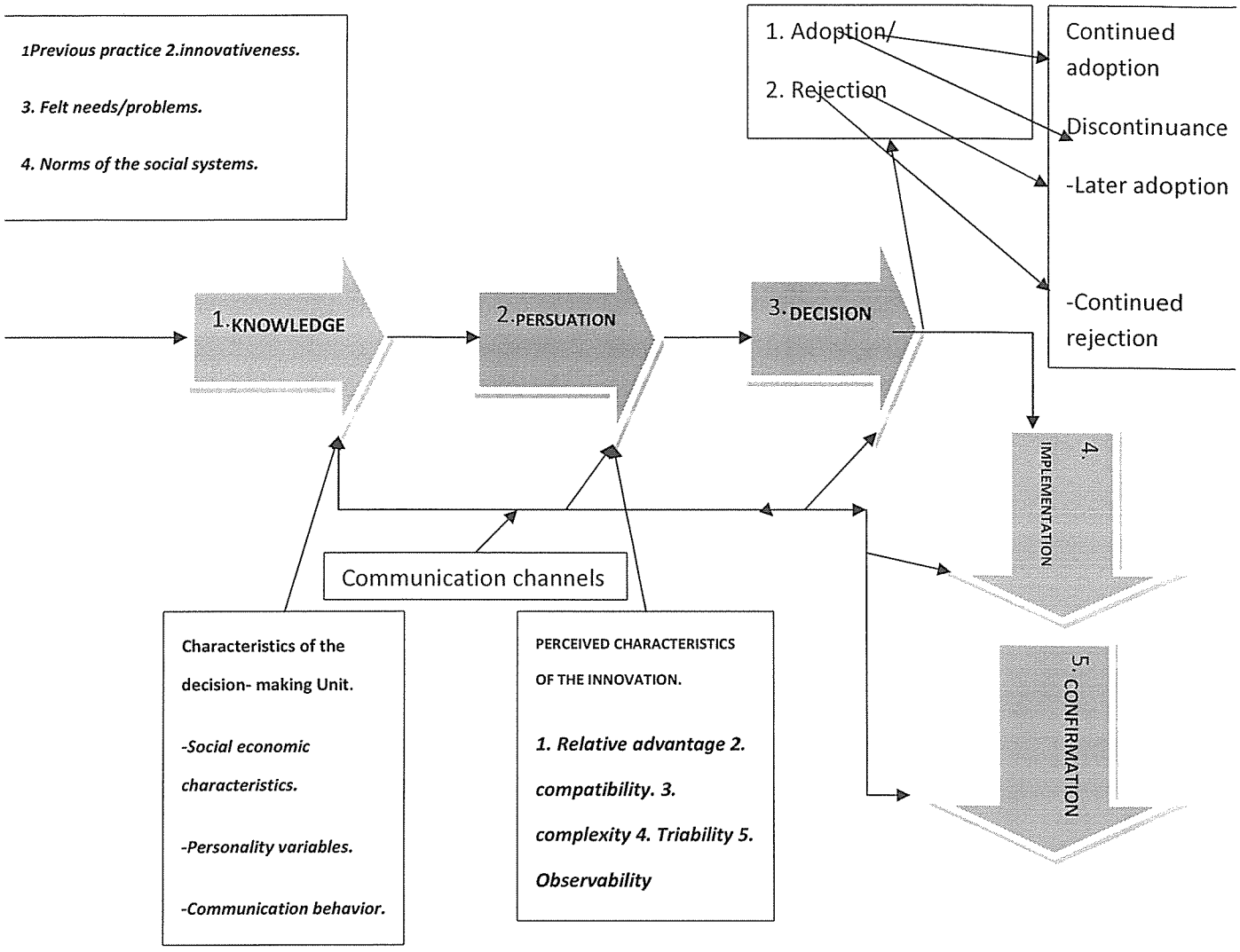
Theories and Models

Certain theories and models associated with the acceptance and take-up of ICT innovations were developed in association with commercial products and business organizations. It is possible that some of the principles involved in introducing an innovative service or product differ in the education sector. However, the following underlying principles are applicable across sectors: (i) Adopter characteristics and motives for embracing innovations. (ii)The innovation's characteristics, its benefits, costs, and associated learning curve, and (ii) Factors in relation to the institution, its culture and services.

Diffusion of Innovation Theory

The factors that affect the spread of innovations are described in several well-known theories. Perry states that scholars in the diffusion theory field 'define diffusion as the process through which some innovation is communicated within a social system.' Perry introduces the idea that 'time' is an important factor in the rate of diffusion. He also stresses the role of individuals and their social influence in the diffusion process. An upsurge of research into diffusion in the late 1960s included practical studies looking at commercial products. These focused on innovations in business settings and were designed to provide insights into improving marketing, as well as describing product dissemination. Scholars, like Rogers, who study communication, concentrated on more theoretical approaches. Rogers' diffusion of innovation theory incorporates 'the innovation-decision process, innovation characteristics, adopter characteristics, and opinion leadership'. Rogers' theory can be divided into three main components: (1)The innovation-decision process (2)The characteristics of an innovation, and (3)Adopter characteristics. A part from these three main components Rogers book on diffusion of innovations emphasizes the important role of change agents in an organization and independent variables and stages related to organizational innovativeness.

Fig 1: Theoretical model of the five stages in Roger's paradigm of the innovation-decision process.

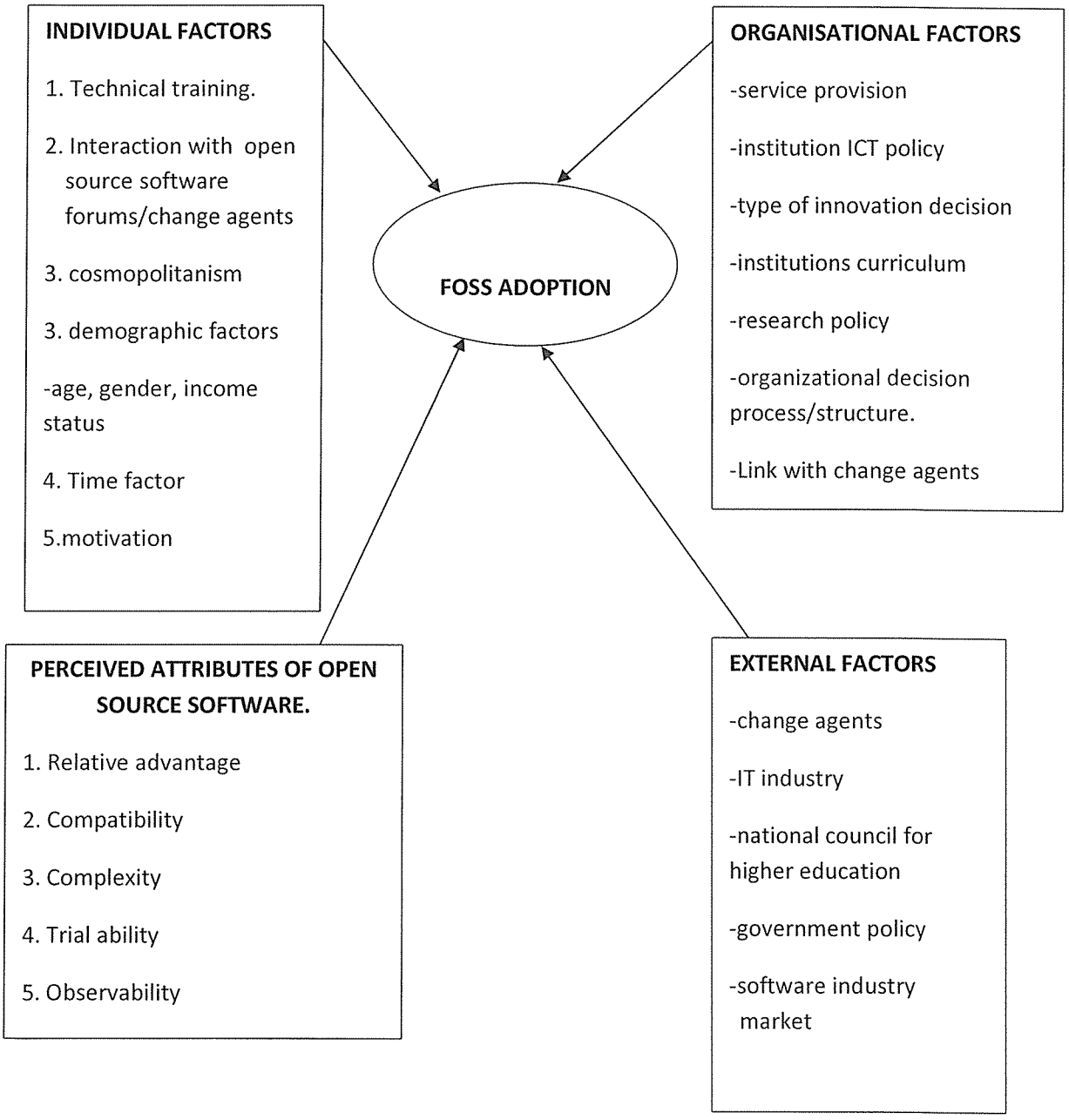


Rogers explains innovation decision process to be a process through which an individual (or other decision making unit) passes from first knowledge of an innovation, to forming attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. The process has five stages; (1)Knowledge, is when the individual is exposed to the innovations existence and gains an understanding of how it functions. There are three types of knowledge

about an innovation; (i) awareness knowledge; which gives information that an innovation exists, (ii)How-to-knowledge; which consists of information necessary to use an innovation properly and (iii)Principles knowledge; which consists of information dealing with the functioning principles underlying how the innovation works. (2)The persuasion stage; is when the individual forms a favorable or unfavorable attitude towards the innovation. (3)Decision; when the individual engages in activities that lead to a choice to adopt or reject the innovation. (4)Implementation; is when the individual puts the innovation into use. At this stage there is also re-invention which is the degree to which an innovation is changed or modified by the user in the process of its adoption and implementation. A higher degree of re-invention leads to faster rate of adoption of an innovation and a greater degree of sustainability of an innovation. (5) Confirmation; is when an individual seeks reinforcement for an innovation-decision already made but may reverse the decision if exposed to conflicting messages about the innovation.

Communication channels refer to means by which a message gets from a source to a receiver. These channels are categorized as (1) Interpersonal or mass media in nature and (2) as originating from either localite or cosmopolite sources. Mass media channels are relatively more important at knowledge stage and interpersonal channels are relatively more important at the persuasion stage.

Fig 2: Conceptual Frame work for investigating FOSS adoption in an Institution of Higher learning in Uganda.



Source: adopted from Glynn, Fitzgerald & Exton (2005).

Related studies

Adopting open source software applications in USA Higher education.

This study published for American Educational Research Association in 2009, outlines the five themes that dominate the software engineering literature and the education literature on the drivers of open-source adoption: (a) social and philosophical benefits, (b) software development methodology benefits, (c) security and risk management benefits, (d) software adoption life cycle benefits, and (e) total cost of ownership benefits. The research is fairly consistent in examining the key drivers of open-source adoption from the perspective of technologists. The overarching assumption is that technologists are the end users and that adoption is driven by the needs and desires of those technical end users, be they philosophical, ease of development, role in the technology adoption life cycle, or perceived cost-effectiveness. This study was therefore focusing on studying user related factors and not developer related factors (Williams, 2009).

Considering open source: a frame work for evaluating software in the new economy by Stanford University.

According to a research bulletin of EDUCAUSE Centre for applied research (2007), an institution considering open source software should have the following strategies;

(i) Applications should be adopted and deployed for low risk pilot in an area not currently supported. For example many institutions are working with sakai software in pilots to support research collaboration, giving them a chance to gain familiarity with software and the community before

considering replacing their course management systems. Similarly libraries are testing DSpace and Fedora for repositories alongside more traditional library systems rather replacing existing functionalities.

(ii)Pieces of open source software can be mixed and perched with other applications. For example uPortal is being used to offer an entry point for administrative applications, while Kuali financial systems and Kuali research administration have modules that can be mixed with other systems. For example, Kuali Enterprice Workflow manages most data changes for PeopleSoft HR at Indiana University.

(iii) Small institutions can work in consortia to share instances of software, spreading cost of ownership over several institutions.

This study elaborates that institutions of higher learning are only a small segment of the software market and therefore do not get substantial attention from commercial developers of software that specifically address the cores needs of these institutions. This calls for institutions themselves to be interested parties in software development if their key functionalities and needs should be met. Open source software would work better for these institutions because of higher provisions for customization.

Commercial adoption of open source software. An empirical study in Beaumont Hospital.

According to this particular study by Glynn, Fitzgerald &Exton (2005),they observe a dramatic increase in commercial interest in the potential of Open Source Software (OSS) over the preceding years. However, given the many complex and novel issues that surround the use of OSS, the process of OSS adoption is not well-understood. This particular study investigated this issue using a framework derived from innovation adoption theory which was then validated in an organization which had

embarked on a large-scale of adoption of OSS. The framework comprised four macro factors – external environment, organizational context, technological context and individual factors. These factors were then investigated on a large-scale survey. Overall, the findings suggest a significant penetration of OSS with general deployment in two industry sectors – consultancy/software house and service/communication – and more limited deployment in government/public sector with education sector not mentioned in particular. This raised need for research on strategies to adopt OSS in institutions of higher learning. However, the existence of a coherent and planned IT infrastructure based on proprietary software served to impede adoption of OSS. Finally, individual relevant factors such as support for the general OSS ideology and committed personal championship of OSS were found to be significant.

Diffusion of ICT innovation and e-business adoption in agribusiness smr's: a developing country perspective-Nigeria.

This paper described how a UNIDO ICT centre innovation acted as a catalyst for ICT adoption and e-business innovation among Small and Medium sized Agribusiness Enterprises in Southeast Nigeria. Diffusion of Innovation Theory (DoI) was applied to investigate the diffusion process of technology. This paper argued that the balance between effort utilized in technology design and the effective diffusion of such innovation must be redressed. Greater emphasis must be placed in instituting end-user social networks as an antecedent that will enable end-user engagement and hence enable effective diffusion of the technology innovation through such end-user networks. This paper concluded the continuous sharing of information about the innovation through social networks constituted the

main success factor enabling the sustainability (maturation) of the technology (Aleke, Udechukwu, & Wainwright, 2011).

Social correlates of innovation diffusion/adoption in educational organizations: The case of ICT in Makerere University.

This study carried out in a public university revealed level of ICT diffusion to be very low. The study was based on individual characteristics of the staff and students, organizational characteristics and perceived characteristics of ICT. Among individual characteristics that explained the rate of adoption included; interaction with ICT change agents inform of ICT planning committees (+), ICT/technological training(+), cosmopolitanism(+), income status and demographic variables. Among perceived ICT characteristics included; relative advantage(+), compatibility(+), usability(+), communicability and for nature of social system they included; unit innovativeness(+), culture(+), organizational structure, ICT change management style(+) (Bakkabulindi, 2007). In this research ICT was looked at in general and its availability was considered relatively obvious. At the same time the population of study was not purposively sampled meaning there was no specific attention to people who are already ICT literate. For this study on open source software adoption/diffusion, the researcher was specifically targeting population that's was already ICT literate and investigating effects of; level of open source software forum interaction, but also only looking at factors that affected these persons preference for open source software or proprietary software and thereafter developing a framework for OSS adoption.

Gaps identified in related studies

The study made by Williams 2009, on adoption of open source software applications in USA higher education concentrated on drivers for open source software adoption from developers perspective and not the final user. This thesis therefore focused on drivers from the user perspective and not developers in an institution of higher learning. On the other hand research made by Educause center for applied research 2007, elaborates that institutions of higher learning form a negligible segment of the software market and therefore do not get substantial attention from commercial developers. This means that institutions of higher learning have to devise means of engaging software developers to include their needs in this growing industry.

Glynn, Fitzgerald and Exton 2005 made a study on commercial adoption of open source software adoption in Beautmont hospital they observed that there were many novel complex issues surrounding open source software use and the process of FOSS adoption is not well understood. The researcher therefore concentrated on taking a study that would help on developing a frame work for open source software adoption for better understanding of FOSS adoption. On a study made by Bakkabulindi, 2007 in Makerere University about social correlates of innovation diffusion/adoption in an educational organization, the researcher observes individual, ICT perceived, and organizational characteristics as correlates of ICT adoption. However this study does not pay attention to variations in software used whether proprietary or open source, also population under study was very general where by respondents were likely to find difficulty in giving credible answers to technical questions asked.

CHAPTER THREE

METHODOLOGY

Research design

This study used causal-correlation research design that involved a random sample selected from general population to understand how the identified factors affect open source software adoption. Causal-correlation research design was selected because under this type of study, the researcher was able to determine the influence of independent variables under study on independent variables and type of relationships that exist thereof. The result from the cross section of the population was used to generalize the factorial influence.

Research population

This research strictly looked at staff who either teach ICT related courses or are executing software related ICT jobs in different departments at the university, this included; College of Applied Science and Technology-ICT courses(52people)(both undergraduate and postgraduate studies), ICT department(10people) (administrative and lab technicians), exams and data bank department(2people), Library (4people)admissions office(4), and the CAST research office (1person) making a total population of 73 staffs.

Sample size

To get the sample size the researcher used Slovin's formula

$$S= \frac{P}{1+P(e)^2}$$

Where S=Sample size

P=Total population **e** =margin error

Therefore **S** $=\frac{P}{1+P(e)^{\wedge}2}$

P =73 e = 5%

$S=\frac{73}{1+73(0.05)^{\wedge}2} = \frac{73}{1+(73*0.0025)} = \frac{73}{1+(0.1825)} = \frac{73}{1.1825} = 61.7 = 62$ members of staff

Sampling procedure

Based on population structure of this study(The deputy principal in charge of teaching, Heads of departments computer studies, lectures in the school of computer studies, Head of ICT department, ICT staff, director school of professional studies, deputy director school of professional studies, staff in the school of professional studies), the researcher used both purposive and simple random sampling method to come up with appropriate sample sizes. In purposive sampling only staff considered having relative exposure to ICT were considered and then simple random sampling was used to get minimum sample. In purposive sampling the researcher chooses the sample based on who they think would be appropriate for the study (Amin, 2005). This was used in this thesis because this study was technologically specialized not to be inferred on none IT staff who would not be able to substantially answer the questionnaire to fulfill its purpose.

Research instruments

The researcher used researcher devised questionnaire. Questionnaire were selected in this study for the following reasons;

Questionnaires were cost effective when compared to face-to-face interviews. Bearing the number of research questions in this study, questionnaires were found to be cost effective.

Questionnaires are easy to analyze. Data entry and tabulation for nearly all surveys can be easily done with many computer software packages.

Questionnaires are familiar to most people. Nearly everyone has had some experience completing questionnaires and they generally do not make people apprehensive.

Questionnaires reduce bias. There is uniform question presentation and no middle-man bias. The researcher's own opinions could not influence the respondent to answer questions in a certain manner. There would be no verbal or visual clues to influence the respondent.

Questionnaires are less intrusive than telephone or face-to-face surveys. When a respondent receives a questionnaire, he/she is free to complete the questionnaire on his/her own time-table. Unlike other research methods, the respondent is not interrupted by the research instrument.

Validity and reliability of the instruments

Initially the researcher gave the questionnaire to 2 software research experts who looked through the questionnaire and made their technical corrections and framing of questions to suit the study purpose. The researcher made these corrections and for purpose of measuring content validity he gave these questionnaires to 5 other experts who were to rate the questionnaire as either "essential, useful or not necessary" These experts included 4 experts in the college of applied science and technology and another one expert in open source software research

outside KIU. All of them concluded the questionnaire to be essential but with minor adjustments which were done. The researcher calculated the content validity ratio/index using Lawshe's, formulae of getting $CVR = (n_e - N/2)/(N/2)$ (Lawshe,1975).

Where

CVR = Content validity Ratio

n_e= Number of panelist indicating essential

N= Number of panelist

CVR = 5-5/2/5/2 =5-2.5/2.5 =1. This is well above the recommended 0.99 for 5 or less panelist.

For reliability, the researcher used reliability analysis tool in SPSS to get Cronbach's Alpha of 0.871 as shown in table 1A. This Statistic is above the recommended 0.7, thus making this instrument reliable.

Table 1A

Reliability Statistics

Cronbach's Alpha	N of Items
.871	20

Data gathering procedures

After approval of the research proposal, the researcher secured a permission letter from college of higher degrees and research to carry out research at KIU. The researcher then approached the deputy principal in charge of learning and teaching in the College of Applied Sciences and Technology for permission to carry out research, the permission was verbally granted and the researcher prepared designed strategy on how to distribute his questionnaires. Because of the small sample size of 62, the researcher personally approached members of staff in ICT departments and gave them questionnaires. The researcher made an appointment list on when to get the questionnaires from members of staff. Phone calls and physical contacts were used as methods of reminding members to return their questionnaires. After receiving the questionnaires, the researcher did data cleaning, coding and data tabulation on these questionnaires and subsequently analyzed them after.

Data analysis

The researcher employed mainly quantitative methods to analyze collected data. ANOVA (ANalysis Of Variance), Multiple Regression Analysis were mainly used in this study. Data was analyzed inform of

frequency tables and co relation coefficients. SPPS was the statistical software package tool used in this study.

Table 1B

Interpretation table

Rank	Response mode	Interpretation
4	Strongly agree	Agree with no doubt
3	Agree	Agree with some doubt
2	Disagree	Disagree with some doubt
1	Strongly disagree	Disagree with no doubt

Table 2

Likert scale mean range Interpretation

Mean range	Interpretation
3.26 – 4	Very satisfied
2.51 – 3.25	Satisfied
1.76 – 2.5	Un satisfied
1 – 1.75	Very unsatisfied

Ethical considerations

The researcher got an introductory letter from the College of Higher Degrees and Research introducing the researcher and explaining intended purpose of data collected. The researcher asked for respondents consent in the questionnaire and they had to sign for every questionnaire responded to. The questionnaire didn't demand name identity of the person responding, therefore the persons were assured of confidentiality. The researcher was committed to non disclosure of availed information beyond what the information was meant for.

Limitations of the study

The researcher encountered difficulty in questionnaire response bearing in mind that the questionnaire basically needed very technical people in area of ICT. The questionnaire was equally very bulky bearing in mind the type of response it had to enlist from respondents. It also took quite some time for the researcher to get a supervisor in the identified area of interest. The researcher's extra workload and responsibilities at the university had a much toll on the researcher's time for research.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter looked at presentation, analysis and interpretation of data on how individual, perceived software, organizational, and external characteristics affect open source software adoption in higher education institutions in Uganda with particular emphasis on KIU as the case study. The study sought views strictly from academic staff teaching ICT courses, administrative staff utilizing ICT systems, and students pursuing ICT related courses at Masters and PHD level. A data collection instrument inform of a questionnaire was used to collect views from the staff and students. The questionnaire consisted of five sections namely A, B, C, D and E. The questionnaire was designed to elicit responses from respondents on their knowledge and level of use of different categories of software as a measure of extent of software adoption as a depended variable; and individual, perceived software characteristic, organizational and external characteristics as independent variables that affect open source software adoption. For purpose of this study, the researcher wished to establish the following;

1. To determine the profile of the respondents with regard to;

    (a) age (b) gender (c)position at University (d)education level(e)academic specialization (f)possession of any other ICT professional qualifications (g)Existing and future interest in ICT professional enrollment.

2. To determine the extent of individual interaction with open source forums, perceived software characteristics, organizational and external characteristics that affect open source software adoption

3. To determine the level of open source software adoption of individuals under study in terms of ability of use, frequency of use of software and preference.

4. To establish if there is a significant relationship between individual characteristic of interacting with open source software forums, individuals perceived software characteristics, organizational characteristics and external characteristics and level of open source software adoption.

5. To design a frame work for open source software adoption in institutions of higher learning in Uganda with KIU as a case sturdy.

Table 3

Determining profile of respondents

Academic specialization		
Computer science	21	33.9
Age		
Below 25	7	11.3
26 -39 years	48	77.4
40 - 54 years	6	9.7
55 years and above	1	1.6
Total	**62**	**100.0**
Gender		
Male	46	74.2
Female	16	25.8
Total	**62**	**100.0**
Position at the university		
HOD	2	3.2
Administrator	6	9.7
Lecturer	20	32.2
Student	19	30.6
Lab technician	8	12.9
NETWORK ADMINISTRATOR	1	1.6
Professor	1	1.6
databank manager	1	1.6
teaching assistant	3	4.8
Instructor	1	1.6
Total	**62**	**100.0**
Education Level		
Bachelors degree	36	58.1
Masters	23	37.1
PhD	3	4.8

Software engineering	2	3.2
IT	14	22.6
Information Systems	15	24.2
Computer engineering	5	8.1
applied computer to industry	1	1.6
Business computing	1	1.6
MBA-IT	1	1.6
Civil Engineering	1	1.6
Computing	1	1.6
Total	62	100.0

ICT professional qualification/certification possessed		
None	34	54.8
Proprietary	26	41.9
Both	2	3.2
Whether enrolled /intend to enroll for any ICT professional qualifications		
Yes	47	75.8
No	15	24.2
Total	62	100.0
Type of ICT qualifications enrolled for/intend to enroll for		
Not applicable	15	24.2
Proprietary only	40	64.5
Open source only	00	00
Both Proprietary and Open source	7	11.3
Total	62	100.0
Possession of any informal self software training		
Yes	32	51.6
No	30	48.4

Table 3 reveals that majority of respondents were between the age of 26-39 with a percentage of 77.4 and only 1.6% were above age of 55 years. Table 3 still reveals that majority of respondents were lecturers with a percentage of 32.2, and highest level of education of the respondents was a bachelor's degree with 58.1% of the respondents falling in this category. This could be attributed to an equally high percentage of master's degree students who were part of this study having a degree as their highest level of qualification. Table 3 still Reveals that, majority of respondents have academic specialty in computer science with a 33.9% majority edge. Computing, civil engineering, MBA-IT, Business computing and applied computer to industry had a minimum percentage of 1.6 each.

Still in this table, majority of respondents (54.8%) possess no other ICT qualifications/certifications. Majority of those who have professional certifications, possess proprietary software related certifications with a 41.9% and 0% respondents have only open source related certifications. 3.2% possess both proprietary and open source software professional qualifications. This means majority of respondents have extra professional skills in proprietary software compared to open source software. On whether the respondents are enrolled or intend to enroll for any ICT professional qualifications/certification, majority 75.8% agree that they are either enrolled or intent to, but the minority 24.2% of the respondents are neither enrolled or intent to enroll for any ICT professional/certification course. Of the 75.8% who are either enrolled/intent to enroll for a course, majority 64.5% of them are either enrolled/intent to enroll into a proprietary software course/certification, with minority 11.3% enrolled/intending to enroll into both proprietary and open source software professional course. 0% of the respondents showed

interest in doing only open source software certification course. This also means that for proprietary software can easily stand on its own unlike open source software training which must be planned hand in hand with proprietary software in mind if it must succeed. On whether the respondents possessed any informal self software training, majority 51.6% agreed with some doubt to have informal self software training while minority 48.4% don't.

Table 4

Extent of Individual Knowledge/Interaction with Open source software forums.

ıdividualKnowledge/Interaction ith Open source software forum	NA&NI	A&NI	ABRI	A&RI	Total	Mean	Interpretation
ıux Group-Uganda	34 (54.8)	16 (25.8)	10 (16.1)	2 (3.2)	62 (100)	1.68	Not aware and not interacted with it
T-Innovations (provision of Linux lministration certifications)	28(45.2)	22(35.5)	9(14.5)	3(4.8)	62(100)	1.79	Aware of its existence but not interacted
ıurce forge (Largest open source ftware applications and directory)	40 (64.5)	13 (21.0)	4(6.5)	5(8.1)	62(100)	1.58	Not aware and not interacted with it
)SSFA	27(43.5)	18(29.0)	13(21.0)	4(6.5)	62(100)	1.90	Aware of its existence but not interacted
ıogle Technology User Group- mpala	24(38.7)	13(21.0)	13(21.0)	12(19.4)	62(100)	2.21	Aware of its existence but not interacted
ıen source software online journals	22(35.5)	21(33.9)	13(21.0)	5(8.1)	62(100)	2.08	Aware of its existence but not interacted
st African Centre for Open Source ftware –Uganda (Awareness and SS skills)	30(48.4)	15(24.2)	8(12.9)	9(14.5)	62(100)	1.94	Aware of its existence but not interacted
ıen source software blogs	19(30.6)	26(41.9)	12(19.4)	5(8.1)	62(100)	2.05	Aware of its existence but not interacted
iliation to Other Open Source ftware community	39(62.9)	12(19.4)	9(14.5)	2(3.2)	62(100)	1.58	Not aware and not interacted with it
erage mean						**1.92**	**Aware of its existence but not interacted**

Legend;

1. NA&NI =Not aware and not interacted with it
2. A&NI = Aware of its existence but not interacted
3. ABRI = Aware but rarely interacts
4. A&RI = Aware and regularly interact with it

Results from Table 4, reveal that Google Technology User Group-Kampala, appears to be the most popular in regard to level of awareness and interactivity with respondents at this institution (19.4%) but Linux Group-Uganda is the least known at the same time least regularly interacted with forum (3.2%). Among all these open source software forum, Source forge (Largest open source software applications and directory) is the least popular with 64.5% of respondents not knowing about its existence at all. On general account, Table 4 suggests that on average, much as there was generally high level of awareness of open source software forums existence among respondents, but majority of these same respondents have not interacted with these forums (mean average of 1.92). This means open source software forum meant to popularize open source software are not yet well utilized by the respondents for open source software adoption.

Table 5
Extent of software characteristics

spondent may prefer open source	SD	D	A	SA	Total	Mean	Interpretation
ce software is cheaper and transparent ode	7	7	28	20	62	2.98	Agree with some doubt
	11.3%	11.3%	45.2%	32.3%	100.0%		
ce software is relatively secure from acks and hackers compared to software	10	11	23	18	62	2.79	Agree with some doubt
	16.1%	17.7%	37.1%	29.0%	100.0%		
rce software is readily available on therefore can be downloaded freely,	5	10	32	15	62	2.92	Agree with some doubt
	8.1%	16.1%	51.6%	24.2%	100.0%		
rce software evolves faster due to ogrammers working on same software o add new features on software	5	12	32	13	62	2.85	Agree with some doubt
	8.1%	19.4%	51.6%	21.0%	100.0%		
ce software is not single vendor locked nultiple free community support online	4	4	26	28	62	3.26	Agree with no doubt
	6.5%	6.5%	41.9%	45.2%	100.0%		
nean						**2.96**	**Agree with some doubt**
Why respondents may not prefer open source software adoption							
fficient skills in open source software se	10	30	14	8	62	2.32	Disagree with some doubt
	16.1%	48.4%	22.6%	12.9%	100.0%		
e software is not very popular in our activities	9	24	24	5	62	2.40	Disagree with some doubt
	14.5%	38.7%	38.7%	8.1%	100.0%		
ce software is Internet intensive and liable Internet is unaffordable	5	20	25	12	62	2.71	Agree with some doubt
	8.1%	32.3%	40.3%	19.4%	100.0%		
rce software continuous evolution sometimes incompatible with existing	8	18	24	12	62	2.65	Agree with some doubt
	12.9%	29.0%	38.7%	19.4%	100.0%		
oprietary software still makes software cheaper' compared to open ware, thus I still work with proprietary ecause it's a cheaper option	7	20	25	10	62	2.61	Agree with some doubt
	11.3%	32.3%	40.3%	16.1%	100.0%		
software are a common requirement ket compared to open source software	10	13	28	11	62	2.65	Agree with some doubt
	16.1%	21.0%	45.2%	17.7%	100.0%		
open source software are not included niversity curriculum.	5	9	28	20	62	3.02	Agree with some doubt
	8.1%	14.5%	45.2%	32.3%	100.0%		
hered with proprietary or open source o long us the software does what I a required skill on my job	12	15	25	10	62	2.53	Agree with some doubt
	19.4%	24.2%	40.3%	16.1%	100.0%		
computer suppliers, supply computers stalled proprietary software platforms vs and not open source like Linux.	5	8	22	27	62	3.15	Agree with some doubt
	8.1%	12.9%	35.5%	43.5%	100.0%		
nean						**2.09**	**Disagree with some doubt**

Legend

1. SD=Strongly Disagree
2. D=Disagree
3. A=Agree
4. SA=Strongly Agree

From table 5, its evident that on being asked why a respondent may prefer open source software over proprietary soft ware, majority of them agreed (highest 45.2 %) with availed reasons as to why they would prefer open source software to proprietary software save for the last reason of open source software not being single vendor locked therefore having multiple free community support online of which respondents strongly believe to be a major advantage of open source software.

On the other hand, on looking at software characteristics that hinder open source software adoption; The factor of respondents having insufficient skills in open source software products use has majority 48.4% of respondents disagree, meaning these majority have enough skills in open source software products use. The 16.1% who strongly disagree still fall in this category of those who believe to have enough open source software skills bringing the percentage to 64.5%. This means KIU as a university is fertile enough in form of open source software skills to adopt it, however the remaining 35.5% of respondents don't have sufficient open software skills which is still a considerable number to consider for training.

On the factor of open source software not being popular in the respondents day to day activities as being a discouragement to adopt, 53.2% disagreed with this statement meaning they acknowledge the importance of open source software in their daily activities but this does not concur with the results in table 3, where 0% of the respondents have enrolled or intent to enroll into only open source software related training, instead the 11.3% that have interest in open source software enrollment/training go hand in hand with proprietary software interest. 46.8% of respondents' content to the fact that open source software are

not popular in their day to day work. This means that this minority group is likely to be less motivated to adopt open source software.

On the factor that open source software is Internet intensive and yet daily reliable Internet is unaffordable, majority of respondents (59.7%)content this statement to be true which implies they don't have access to affordable Internet access, the 40.3% believe Internet access is affordable. This minority group could be attributed to those who earn enough to have their personal mobile internet access or those who hold offices with Internet access.

In Table 5, 56.4% majority of respondents admit using pirated proprietary software instead of open source software on basis that the pirated software is cheaper while 43.6% minority of the respondents don't agree to this. This means that much as majority 77.5% of respondents in table 5 acknowledged being motivated to adopt open source software by virtue of them being cheap compared to proprietary software, the vice of proprietary software piracy at 56.4% among respondents at KIU still encourages poor open source software adoption. On question of whether proprietary software are a common requirement on job market compared to open source software, majority 62.9% of the respondents agree to this statement and minority 37.1% don't. This means that the 62.9% of these respondents are more likely to have interest in proprietary software other than open source software for purpose of competitive advantage on the job market. This may also explain why in table 3 majority 64.5% of the respondents have either enrolled or intend to enroll in strictly proprietary software instead of open source software.

Table 5, still reveals that 77.5% of respondents agree to the fact that open source software is not sufficiently provided for in the university curriculum and yet to ably get necessary skills to achieve the ICT millennium development goal, the curriculum should be a key target to instill skills among current and future adopters of open source software in an institution. 56.4% majority of respondents in table 5 are not bothered about type of software in question so long as it's a required skill at job market. This fact combined with belief that proprietary software are a common requirement in the job market create more favor for proprietary software adoption. Majority 79% of respondents are attracted to proprietary software and not open source software majorly because of perceived effective supply chain of proprietary software. The fact of proprietary software being pre installed by suppliers on personal computers creates direct marketing of their software. This could partly be due to fact of trust in what is supplied by experts, ensuring given warranties are not violated by changing pre installed software, poor installation/un installation of software skills.

Table 6

Extent of Organizational Characteristics

organizational characteristics	SD	D	A	SA	Total	Mean	Interpretation
Our institution has an ICT policy that favors open source software adoption	25	23	12	2	62	1.85	Disagree with with some doubt
	40.3%	37.1%	19.4%	3.2%	100.0%		
Our institution has a clear software research policy that favors open source software use	25	31	5	1	62	1.71	Disagree with no doubt
	40.3%	50.0%	8.1%	1.6%	100.0%		
Our institution has a software incubation center	38	17	7	0	62	1.50	Disagree with no doubt
	61.3%	27.4%	11.3%	0.0%	100.0%		
There is regular provision of open source software refresher training courses	33	21	5	3	62	1.65	Disagree with no doubt
	53.2%	33.9%	8.1%	4.8%	100.0%		
Our institution uses licensed software	23	19	16	4	62	2.02	Disagree with some doubt
	37.1%	30.6%	25.8%	6.5%	100.0%		
Our institution uses pirated software	8	13	20	21	62	2.87	Agree with some doubt
	12.9%	21.0%	32.3%	33.9 %	100.0%		
The institution where I work determines the software I use on my personal computer while at work?	22	17	18	5	62	2.10	Disagree with some doubt
	35.5%	27.4%	29.0%	8.1%	100.0%		
I have an influence on software installed on university computers	20	19	17	6	62	2.15	Disagree with some doubt
	32.3%	30.6%	27.4%	9.7%	100.0%		
The institution where I work is an active member to some active external software community in areas of software development	22	22	16	2	62	1.97	Disagree with some doubt
	35.5%	35.5%	25.8%	3.2%	100.0%		
students/lecturers at our institution have delivered finished software products/research to external organization/community	14	24	23	1	62	2.18	Disagree with some doubt
	22.6%	38.7%	37.1%	1.6%	100.0%		
The institution management provides sufficient funding for software requirements	33	21	5	3	62	1.65	Disagree with no doubt
	53.2%	33.9%	8.1%	4.8%	100.0%		
Our institution lecturing workload is fair enough to allow me concentrate on self training in different software	18	22	17	5	62	2.15	Disagree with some doubt
	29.0%	35.5%	27.4%	8.1%	100.0%		
Average mean						**1.98**	**Disagree with some doubt**

Table 6, reveals that KIU as an institution had majority of respondents (40.3%) disagreed with no doubt to the fact that the institution had an ICT policy that favored open source software adoption but on the other

hand minority 3.2% of the respondents agreed with no doubt to this same fact. A total % of 77.4 (disagreed with no doubt, Disagreed with doubt) that the institution ICT policy didn't favor open source software against the total minority 22.7% (agreed with no doubt, Agreed with doubt) to the same. On average (arithmetic mean of 1.98) the respondents disagreed with the fact that open source software was well provided for in KIU ICT policy. This means that according to respondents, open source software is not clearly incorporated in University ICT programs and this has a considerable negative effect to its adoption. On whether the institution had a clear software research policy that favors open source software use, majority of respondents (50%) disagreed with doubt with only 1.6% minority strongly agreeing to the same and on average the response (arithmetic mean, 1.71) lied with those who disagreed with no doubt. This means that on average, respondents feel the existing research policy doesn't encourage open source software adoption and thus for any for any success in open source software adoption there should be deliberate efforts by the institution to include open source software in university research projects.

Table 6 reveals that on average (arithmetic mean 2.02), the respondents believe their institution doesn't use licensed software, with majority 37.1% of them agreeing with no doubt and minority 6.5% disagreeing with no doubt. This is still supported with facts from same table where on average (arithmetic mean, 2.87), the respondents agree with some doubt to the institution using pirated software with majority 33.9% agreeing with no doubt supporting this fact. This is still reflected at individual level in table 6 where 56.4% of respondents admit using pirated software. This cumulative effect of software piracy needs deliberate efforts to address it,

if open source software should have a fair adoption ground with proprietary software.

On whether the institution where the respondent works determined the software he/she uses on their personal computer, 35.5% majority of them disagree with no doubt and similarly, average number of the respondents (arithmetic mean.2.15) content that they have no influence on software installed on university computers. This explains the important role dictated by the curriculum and university policy in terms of type of software to be adopted. 53.2% majority of respondents agree with no doubt that the institution didn't provide enough funding for software requirements but only minority 4.8% agreed with no doubt that the institution was funding enough. This could be an area of interest to the institution to adopt cheaper open source software but still from the results in this table that could be attributed to proprietary software piracy. On average (arithmetic mean 2.15)the respondents disagreed with some doubt that they have low workload that gives them fair time on self software training. This leaves limited room for open source software training which have limited training opportunities and clearly structured job market.

Table 7

Extent of external characteristics

	SD	D	A	SA	Total	**Mean**	**Interpretation**
Ve get reliable Internet services at ur institution	29	20	9	4	62	1.81	Disagree with some doubt
	46.8%	32.3%	14.5%	6.5%	100.0 %		
Existing Internet services at our nstitution is good enough for egular software updates	29	20	13	00	62	1.74	Disagree with no doubt
	46.8%	32.3%	21.0%	00	100.0 %		
here is sufficient support from overnment towards open source oftware adoption	20	34	8	00	62	1.81	Disagree with some doubt
	32.3%	54.8%	12.9%	00	100.0 %		
Ve have Interuniversity open ource software collaboration ommittee at our institution	22	30	8	2	62	1.84	Disagree with some doubt
	35.5%	48.4%	12.9%	3.2%	100.0 %		
pen source software hampions/promoters in Uganda re doing enough to promote open ource software in our institution	17	33	11	1	62	1.94	Disagree with some doubt
	27.4%	53.2%	17.7%	1.6%	100.0 %		
he national council for higher ducation is doing enough to romote open source software doption in our curriculum	32	27	2	1	62	1.55	Disagree with no doubt
	51.6%	43.5%	3.2%	1.6%	100.0 %		
verage mean						**1.78**	**Disagree with some doubt**

From table 7, the question on whether internet provision at the institution is reliable, majority of respondents (46.8%) disagreed with no doubt with this statement with only minority 6.5% agreeing with no doubt to the same. On average (arithmetic mean 1.81) the respondents disagree with some doubt that the institution gets reliable internet services. This could be attributed to either poor external internet service providers or limited bandwidth to meet staff needs or still inability to have own internet services. Still on whether the respondents believed the available internet services to be sufficient for regular software updates, they averagely (arithmetic mean 1.74) disagreed with no doubt to this fact and majority 46.8% disagreed with no doubt to this effect. This means that with open source software that needs regular updates online, the available internet

services are not sufficient to meet this demand. This in turn has a negative effect to open source software adoption at this institution.

On whether there is sufficient support from government towards open source software adoption, the respondents averagely (arithmetic mean 1.81) disagreed with some doubt to this effect with majority (54.8%) falling in this same category. There was no respondent at all (0%) who agreed with no doubt to the effect that government gives any support for open source software adoption. This in turn means that either the government is doing nothing at all in regard to open source software adoption or the respondents are not aware of government efforts towards open source software adoption or there is limited sensitization of government efforts towards open source software adoption. On the other hand, on the point of whether the institution has an Interuniversity open source software collaboration committee, majority of the respondents disagreed with some doubt (48.4%) with this statement having only minority 3.2% agreeing with no doubt to the same.

Majority 53.2% disagreed with some doubt that open source software promoters are doing enough to promote open source software adoption and this goes to 80.6% cumulative total for those who disagree and strongly disagree. Only 19.4% of the respondents agreed with some doubt that external promoters are doing enough. This is supported by results from table 4, where majority of respondents are aware of existence of open source software forums but have not interacted with them at all (average arithmetic mean of 2.0). On whether the national council for higher education is doing enough to promote open source software adoption in the university curriculum, majority 51.6% disagree with no doubt while minorities 1.6% agree with no doubt. This means

that the respondents either believe the national council of higher education is not working hand in hand with the university to promote open source software inclusion in curriculum or they are approving curriculum with limited content on open source software. The national council of higher education having less efforts in open source software adoption in institution of higher learning can also be very significant in hampering its adoption.

Level of open source software adoption of individuals under study.

Table 8

Ability to use open source and Proprietary Software

Ability of software use	Not at all acquainted	Not well acquainted	comfortable with its use	well versed with its use	Total	Mean	Interpretation
Ability to use Open office	16.1	21.0	37.1	25.8	100	1.73	Very unsatisfied with its use
Ability to use Microsoft Office	**.0**	**3.2**	**21.0**	**75.8**	**100**	**2.73**	**Satisfied with its use**
Ability to use WAMP Web Server Packages	**12.9**	**11.3**	**41.9**	**33.9**	**100**	**1.97**	**Unsatisfied with its use**
Ability to use XAMPP Web Server Packages	43.5	21.0	19.4	16.1	100	1.08	Very unsatisfied with its use
Ability to use VB.NET/VB	**9.7**	**21.0**	**35.5**	**33.9**	**100**	**1.94**	**Unsatisfied with its use**
Ability to use JAVA	12.9	35.5	35.5	16.1	100	1.55	Very unsatisfied with its use
Ability to use Windows OS Operating systems	**.0**	**1.6**	**32.3**	**66.1**	**100**	**2.65**	**Satisfied with its use**
Ability to use Linux Operating systems	12.9	22.6	40.3	24.2	100	1.76	Unsatisfied with its use
Ability to use Sakai	71.0	16.1	9.7	3.2	100	1.02	Very unsatisfied with its use
Ability to use Moodle	53.2	21.0	16.1	9.7	100	1.04	Very unsatisfied with its use

Table 8 reveals that the respondents on average are only well versed with use of Microsoft office and windows operating system (arithmetic mean of 2.73 and 2.65 respectively), unlike the rest they deem only comfortable with on average, save for sakai and Moodle of which averagely the respondents are not acquainted with at all with mean of 1.02 and 1.04 respectively. Averagely, the respondents are more acquainted with proprietary software use that open source in these selected common categories

Table 9

Frequency of use of open source and Proprietary Software

equency of use	Not used at all	Ever used but does not use it any more	Uses it once in a while	Uses it frequently	Total	Mean	Interpretation
equency of use of Open ice	17.7	25.8	35.5	21.0	100	1.60	Very rarely used
equency of use of Microsoft ice	.0	3.2	9.7	87.1	100	2.84	Frequently used
equency of use of WAMP b Server Packages	12.9	11.3	41.9	33.9	100	1.97	Rarely used
equency of use of XAMPP b Server Packages	45.2	22.6	25.8	6.5	100	1.10	Very rarely used
equency of use of /VB.NET	9.7	24.2	33.9	32.3	100	1.89	Rarely used
equency of use of JAVA	12.9	37.1	32.3	17.7	100	1.55	Very rarely used
equency of use of Windows Operating systems	.0	1.6	22.6	75.8	100	2.74	Frequently used
quency of use of Linux erating systems	12.9	32.3	38.7	16.1	100	1.58	Very rarely used
quency of use of Sakai	72.6	17.7	8.1	1.6	100	1.01	Very rarely used
quency of use of Moodle	54.8	22.6	11.3	11.3	100	1.05	Very rarely used

Table 9 reveals very low level of software activity among staff with majority respondents falling in category of using the software once in a while(average arithmetic mean of 2), but still windows OS and Microsoft Office are used frequently(average arithmetic mean falling on 3).

Table 10

Preference of use between open source and Proprietary Software

	Frequency	Percent
Preference of use for Open office or Microsoft office Open Office	5	8.1
Microsoft office	52	83.9
Both of them	5	8.1
Total	**62**	**100.0**
Preference of use for Web Server Packages None	8	12.9
WAMP	46	74.2
XAMPP	7	11.3
Both WAMP and XAMPP	1	1.6
Total	**62**	**100.0**
Preference of use for Web Server Packages None of them	4	6.5
VB.NET/VB	36	58.1
JAVA	16	25.8
Both of them	6	9.7
Total	**62**	**100.0**
Preference of use for Windows OS or Linux Windows OS	47	75.8
Linux OS	7	11.3
Both of them	8	12.9
Total	**62**	**100.0**
Preference of use for Sakai or Moodle None	42	67.7
Sakai	2	3.2
Moodle	17	27.4
Both of them	1	1.6
Total	**62**	**100.0**

From table 10, majority of respondents showed preference for proprietary software over open source software with leading percentages of preference. Proprietary software in this category included; Microsoft Office, WAMP, VB.NET/VB, Windows OS. Open source software in this category included; Open office, XAMPP, java, Linux, Sakai and Moodle. Majority of these respondents gave main reasons of software preference to be; availability of the software and user friendliness of the software.

Very few respondents agreed that security, price of software, online presence, compatibility with other programs lured them to adopt the software while these being the would be strong points for open source software.

Table 11

Reasons for software preference as given by respondents.

Reasons for preference of use of open office/Microsoft office	Preference of use for Open office or Microsoft office			
	Open Office	Microsoft	both of them	Total
None	0	3	0	3
Widely available	0	23	1	24
user friendly	1	23	0	24
they compliment one another	0	0	1	1
open office is virus resistant and ms office is user friendly	0	0	1	1
am well acquainted with it	0	2	0	2
easy and opens all ms office work	1	0	0	1
open office is secure	1	0	0	1
MS OFFICE has more features than open office	0	1	0	1
Open office is free and ms office is	0	0	1	1

readily available				
Open office is good for networking and ms office is commonly	0	0	1	1
compatible with other operating systems	1	0	0	1
its free with open source code	1	0	0	1
Total	**5**	**52**	**5**	**62**

Reasons for preference of use of WAMP/XAMPP	**Preference of use for Web Server Packages**				
	None	WAMP	XAMPP	Both WAMP & XAMPP	
None	7	2	0	0	9
More exposed to it	1	8	1	0	10
Good in web design	0	4	0	0	4
both are good	0	0	0	1	1
User friendly	0	21	1	0	22
Compatibility with other programs	0	3	1	0	4
Allows importation of csvs	0	1	0	0	1
readily available	0	4	2	0	6
because its open source	0	1	0	0	1
upgraded version	0	0	1	0	1
regular updates	0	1	0	0	1

cost effective	0	1	0	0	1
runs on Linux which is familiar	0	0	1	0	1
Total	**8**	**46**	**7**	**1**	**62**

Reasons for preference of use of VB.NET/VB / JAVA					
	none	**VB.NET/VB**	**JAVA**	**both**	**Total**
not applicable	4	0	2	1	7
user friendly	0	25	4	0	29
good in database designing	0	1	0	0	1
widely used	0	3	3	0	6
Its secure	0	0	1	0	1
VB.NET/VB has advanced features and java is simpler	0	0	0	1	1
has more additional tools	0	2	1	0	3
got some training in it	0	3	1	0	4
easy codes	0	2	1	0	3
VB.NET/VB is good for interface design and java good for designing scr	0	0	0	1	1
requirement for studies	0	0	0	1	1
easy connection to online applications	0	0	1	0	1
VB.NET/VB is user friendly and java is platform flexible	0	0	0	1	1
platform independent and support for mobile devices	0	0	1	0	1
reusable codes and runs on Linux	0	0	1	0	1
VB.NET/VB is dynamic and java is	0	0	0	1	1

common					
Total	**4**	**36**	**16**	**6**	**62**

Reasons for preference of use of Windows OS/Linux OS	**Preference of use for Windows OS or Linux**			
	Windows OS	**Linux OS**	**both**	**Total**
User friendly	33	0	0	**33**
Availability on market	9	0	1	**10**
more secure than windows	1	4	0	**5**
Windows OS is user friendly and Linux OS is more secure	0	0	6	**6**
free code and readily down loadable	0	3	0	**3**
windows is compatible with many soft wares	1	0	0	**1**
Windows highly used in sub-Saharan Africa and Linux i virus	0	0	1	**1**
its cheap and easy to use	1	0	0	**1**
allows for more 3rd party application development	1	0	0	**1**
Easy to install	1	0	0	**1**
Total	**47**	**7**	**8**	**62**

Results from table11, show that reasons for adopting proprietary software over open source software mainly lie on how available, user friendly, or how exposed the respondents are to these software. This cuts across different categories of software; office software, web server software and programming software adoption. This means that these factors mentioned are considered very important by the respondents for adopting particular software. Still in this same table11, it proves that majority of

respondents rely on availability of software and user friendliness to adopt one category of software(Windows OS) over the other but on Linux and windows OS, those who prefer open source software (Linux OS) mainly give software security and free code as reasons for its adoption. From Table 11, it could be concluded that for effective software adoption by respondents in this institution there is need for ensuring effective systems for software supply and user friendliness of specific software for their adoption to occur.

Significant Relationship Between extent of Individual knowledge/interaction with open source forums/tools, Extent of Perceived Software Characteristics, Extent of Organizational Characteristics and Extent of External Characteristics and Level of Open Source Software Adoption.

This part of the study mainly focused on finding out whether the various independent variables Individual knowledge/interaction with open source forums/tools, Perceived open source software characteristics, Organizational characteristics and external characteristics had a significant relationship with the depended variable (open source software adoption).

Table 12

Statistical results on whether there is a significant correlation between Extent of Software Characteristics and Level of Open Source Software Adoption (ability of use).

Open source Software Characteristics Preferred by respondents Verses	**r-value**	**Sig.**	**Interpretation**	**Decision on Ho**
Ability to use Open office	.287	.024	Significant correlation	Rejected
Ability to use XAMPP Web Server Packages	.298	.019	Significant correlation	Rejected
Ability to use JAVA	.264	.038	Significant correlation	Rejected
Ability to use Linux Operating systems	.457	.000	Significant correlation	Rejected
Ability to use Sakai	.314	.013	Significant correlation	Rejected
Ability to use Moodle	.211	.100	No significant correlation	Accepted
Overall Open Source Software Ability	**.456**	**.000**	**Significant correlation**	**Rejected**
Open source Software Characteristics Not preferred by respondents Verses...				
Ability to use Open office	.075	.561	No significant correlation	Accepted
Ability to use XAMPP Web Server Packages	.315	.013	Significant correlation	Rejected
Ability to use JAVA	.249	.051	No significant correlation	Accepted
Ability to use Linux Operating systems	.105	.416	No significant correlation	Accepted
Ability to use Sakai	.156	.226	No significant correlation	Accepted
Ability to use Moodle	.030	.819	No significant correlation	Accepted
Overall Open Source Software Ability	.235	.066	**No significant correlation**	**Accepted**

Results in table 12, indicate that on overall (r=0.456 and sig value=.000 less than 0.05)there is a significant relationship between those open source software characteristics perceived to be advantageous by the respondents and the ability to use open source software by the same respondents. On the other hand, the results from the same table 12 still indicate that, on overall (r=0.235 and sig value=.066 more than 0.05), there is no significant relationship between those open source software characteristics perceived to be disadvantageous by the respondents and their ability to use open source software.

Table 13

Statistical results on whether there is a Significant correlation Between Extent of Software Characteristics and Level of Open Source Software Adoption (Frequency of use).

Open source software Characteristics Preferred Verses...	**r-value**	**Sig.**	**Interpretation**	**Decision on Ho**
Frequency of use of Open office	.272	.032	Significant correlation	Rejected
Frequency of use of XAMPP Web Server Packages	.322	.011	Significant correlation	Rejected
Frequency of use of JAVA	.248	.052	No significant correlation	Accepted
Frequency of use of Linux Operating systems	.472	.000	Significant correlation	Rejected
Frequency of use of Sakai	.335	.008	Significant correlation	Rejected
Frequency of use of Moodle	.232	.070	No significant correlation	Accepted
Overall Open Source Software frequency	**.419**	**.001**	**Significant correlation**	**Rejected**
Open source software Characteristics Not Preferred Verses...				
Frequency of use of Open office	.069	.594	No significant correlation	Accepted
Frequency of use of XAMPP Web Server Packages	.354	.005	Significant correlation	Rejected
Frequency of use of JAVA	.289	.023	Significant correlation	Rejected
Frequency of use of Linux Operating systems	.058	.652	No significant correlation	Accepted
Frequency of use of Sakai	.042	.743	No significant correlation	Accepted
Frequency of use of Moodle	.062	.634	No significant correlation	Accepted
Overall Open Source Software frequency	**.269**	**.035**	**Significant correlation**	**Rejected**

Results in table 13 indicate that on overall (r=0.419 and sig value=.001 less than 0.05)there is a significant relationship between those open source software characteristics perceived to be advantageous by the respondents and the frequency of use of open source software by the same respondents. On the other hand, the results from the same table 13, still indicate that, on overall (r=0.269 and sig value=.035 less than 0.05), there is a significant relationship between those open source software characteristics perceived to be disadvantageous by the respondents and their frequency to use open source software.

Table 14

Statistical results on whether there is a Significant correlation Between Extent of Organizational Characteristics and Level of Open Source Software Adoption

Organizational Characteristics Vs...	**r-value**	**Sig.**	**Interpretation**	**Decision on Ho**
Ability to use Open office	-.056	.664	No significant correlation	Accepted
Ability to use XAMPP Web Server Packages	-.234	.067	No significant correlation	Accepted
Ability to use JAVA	-.309	.015	Significant correlation	Rejected
Ability to use Linux Operating systems	-.272	.032	Significant correlation	Rejected
Ability to use Sakai	-.366	.003	Significant correlation	Rejected
Ability to use Moodle	-.243	.057	No significant correlation	Accepted
Overall Open Source Software Ability	**-.361**	**.004**	**Significant correlation**	**Rejected**
Organizational Characteristics Vs...				
Frequency of use of Open office	-.015	.909	No significant correlation	Accepted
Frequency of use of XAMPP Web Server Packages	-.183	.154	No significant correlation	Accepted
Frequency of use of JAVA	-.275	.030	Significant correlation	Rejected
Frequency of use of Linux Operating systems	-.155	.228	No significant correlation	Accepted
Frequency of use of Sakai	-.245	.055	No significant correlation	Accepted
Frequency of use of Moodle	-.180	.161	No significant correlation	Accepted
Overall Open Source Software frequency	**-.267**	**.036**	**Significant correlation**	**Rejected**

Results from Table 14, indicate that the existing organizational characteristic of the university by the time of this sturdy, in general terms,

have a significant negative correlation with ability of use of open source software(r-value=-.361 and sig value=.004). This means that existing organizational characteristics with respect to open source software do not favor adoption of open source software in regard to ability of use at this institution. Similarly organizational characteristics of the university in regard to open source software adoption, have a significant negative correlation to how frequent open source software is used at this institution (r-value =0.267 sig-value=0.036).

Table 15

Statistical results on whether there is a significant Relationship Between Extent of External Characteristics and Level of Open Source Software Adoption.

Extent of external Characteristics Vs...	**r-value**	**Sig.**	**Interpretation**	**Decision on Ho**
Ability to use Open office	-.140	.278	No significant correlation	Accepted
Ability to use XAMPP Web Server Packages	-.276	.030	Significant correlation	Rejected
Ability to use JAVA	-.411	.001	Significant correlation	Rejected
Ability to use Linux Operating systems	-.403	.001	Significant correlation	Rejected
Ability to use Sakai	-.370	.003	Significant correlation	Rejected
Ability to use Moodle	-.126	.330	No significant correlation	Accepted
Overall Open Source Software Ability	**-.421**	**.001**	**Significant correlation**	**Rejected**
Extent of External Characteristics Vs...				
Frequency of use of Open office	-.149	.248	No significant correlation	Accepted
Frequency of use of XAMPP Web Server Packages	-.325**	.010	Significant correlation	Rejected
Frequency of use of JAVA	-.308*	.015	Significant correlation	Rejected
Frequency of use of Linux Operating systems	-.332**	.008	Significant correlation	Rejected
Frequency of use of Sakai	-.254*	.046	Significant correlation	Rejected
Frequency of use of Moodle	-.137	.290	No significant correlation	Accepted
Overall Open Source Software frequency	**-.343**	**.006**	**Significant correlation**	**Rejected**

External characteristics as reflected in Table 15, have an overall significant negative correlation to both ability and frequency of use of open source software. This means existing external characteristics do not positively relate with open source software adoption.

Table 16

Regression Analysis on individual characteristics, perceived software characteristics, organizational characteristics and external Characteristics and Level of Open Source Software Adoption in Terms of Ability To use.

Regression analysis, in general sense, means the estimation or prediction of the unknown value of one variable from the known value of the other variable.

Variables Regressed	**Adjusted R^2**	**F**	**Sig.**	**Interpretation**	**Decision on Ho**
Ability to Use Open Source Software Verses Individual level of interaction with open source software forums, Software characteristics, Organizational & External Characteristics	.345	7.431	.000	Significant influence	Rejected
Standardized Coefficients	**Beta**	**T**	**Sig.**		
(Constant)		.358	.721	No significant influence	Accepted
Individual Characteristics	.268	2.541	.014	Significant influence	Rejected
Preferred	.343	3.090	.003	Significant influence	Rejected
Not preferred	.043	.391	.698	No significant influence	Accepted
Organizational Characteristics	-.102	-.811	.421	No significant influence	Accepted
External Characteristics	-.244	-1.926	.059	No significant influence	Accepted

According to results in table 16, the variables regressed; Individual knowledge/interaction with open source software forum, perceived open source software preferred/not preferred, organizational characteristics and external characteristics have an overall significant influence on (sig value of 0.000) on ability to use open source software of 34.5% (adjusted R square =0.345). On specific terms, individual and perceived preferred software characteristics have a positive significant influence on ability to use open source software, the non preferred have no significant influence and both organizational and external characteristics have a negative influence on ability to use of open source software but which is not significant.

Table 17

Regression Analysis on individual characteristics, perceived software characteristics, organizational characteristics and external Characteristics and Level of Open Source Software Adoption in Terms of frequency of use.

Variables Regressed	**Adjusted R^2**	**F**	**Sig.**	**Interpretation**	**Decision on Ho**
Frequency of Use of Open Source Software Adoption Verses Individual, Software characteristics, Organizational & External Characteristics	.315	6.609	.000	Significant influence	Rejected
Standardized Coefficients	**Beta**	**T**	**Sig.**		
(Constant)		-.195	.846	No significant influence	Accepted
Individual Characteristics	.340	3.150	.003	Significant influence	Rejected
Preferred	.324	2.849	.006	Significant influence	Rejected
Not preferred	.099	.875	.385	No significant influence	Accepted
Organizational Characteristics	-.037	-.288	.774	No significant influence	Accepted
External Characteristics	-.175	-1.350	.183	No significant influence	Accepted

Table 17, Reveals that on overall basis the independent variables; Individual knowledge/interaction with open source software forum, perceived open source software preferred/not preferred, organizational characteristics and external characteristics have a positive significant effect on open source software adoption(frequency of use(adjusted R square of 0.315)) of 31.5%. On specific terms individual characteristics of interacting with open source software forum and the preferred open source software characteristics have a positive significant influence on open source software adoption (frequency of use of open source software). Existing organizational and external characteristics on the other hand have a no significant influence on open source software adoption.

CHAPTER FIVE

FINDINGS, CONCLUSIONS, RECOMMENDATIONS

This chapter looks at findings of the study with regard to answering specific research questions, conclusions drawn from the findings and finally recommendations based on conclusions.

Findings

The findings on respondents profile revealed that majority of the respondents at this university were male with minority of them being female. Of both male and female, majority of them have an average age range of 26 -39 years. This means KIU as an institution has majority staffs that are still very young and therefore large room of career influence with regard to software adoption influence. On issue of position/responsibility held, it was found that majority of respondents were lecturers, lab technicians and assistant lecturers/teaching assistants still pursuing their studies with very minor distribution on professors, administrators, HOD's, databank manager and lab technicians. On question of highest qualification attained by respondents, majority of them were found to have a bachelor's degree with 58.1% of the respondents falling in this category. This could be attributed to an equally high percentage of staff doing master's degree on staff development program.

In terms of academic specialization, the staffs were mainly specializing in areas of computer science, IT and Information systems with limited representation in other areas of computer studies like software engineering. This means that much as the theory of software could be covered in these popular courses, serious software development career

found in software engineering curriculum is minimum due to limited number of scholars in this category. On investigating on other ICT professional qualifications possessed by KIU staff, majority of them possessed proprietary related courses and even those that intended to enroll still had majority interest in proprietary software related courses. This demonstrates the faith the staff have in proprietary software as a career but also how much strategy needs to be put in place to promote open source software related career.

The findings on level of open source software adoption indicate that there was more adoption of proprietary software than open source software. Measuring level of adoption on basis of how much aware, how much able and how frequent the staff use particular software, it was found that generally speaking proprietary software had an upper hand over open source software. The proprietary software considered in this study were; Microsoft Office, WAMP Web Server Packages, VB.NET/VB, Windows OS Operating systems. These software represent major software categories in areas of office applications, online web applications, interface applications and operating systems. On the other hand, open source software consisted of; open office, XAMMP, Java, linux, sakai and moodle. Generally the members of staff gave main reasons of software preference to be; availability of the software and user friendliness of the software. Very few respondents agreed that security, price of software, online presence, compatibility with other programs lured them to adopt the software while these being the would be strong points for open source software. But this could be attributed to already confessed high levels of proprietary software piracy which eliminates the issue of software price competition. To talk of any credible competition between proprietary and

open source software the issue of software piracy must be strongly worked against both at institutional, individual and external level.

On investigating the extent to which individual staffs interact with open source software forums/tools, it was discovered that there was generally high level of awareness of open source software forums existence among staff but there was very minimal interactive activity with these forums as a whole. This discrepancy is possibly brought about by limited internet services at the university which would enable regular interfacing with online forums. This definitely negatively affects level of open source adoption since the staffs are not sufficiently in touch with the leading open source ambassadors. But on specifics, it was found that Google Technology User Group-Kampala was found to be the most used forum, this was mainly attributed to its physical presence among staff and students as its Google ambassadors. Google went ahead to offer smart phones as incentives to staff with viable mobile applications and also offered many free workshops on mobile mapping. This promoted awareness and motivation to staff to adopt their applications. Contrary to Google Technology User Group-Kampala, Source forge (Largest open source software applications and directory) is the least popular among staffs and yet it houses very many open source software projects which staff could borrow a leaf from.

These poor levels of interaction are even worse with other local open source software change agents in Kampala who have not made effective strategy to penetrate the ICT literates who have ready available necessary skills to adopt open source software. On establishing whether the level of staff interaction with open source software forums had a relationship or significant effect to open source software, it was discovered that they had

a significant relationship and significant influence on adoption thus answering the research question on "whether the level of staff interaction with open source software forums/tools had an effect on open source software adoption".

To answer the research question on whether the extent of staff perceived open source software characteristics affect open source software adoption; the study grouped these characteristics into preferred characteristics of open source software and non-preferred characteristics of open source software. The findings from this study were that, there was a significant relationship between preferred characteristics of open source software and their ability and frequency of use. The preferred characteristics were still found to have a significant influence on adoption of open source software (both on ability and frequency of use of open source software).

Among the preferred characteristics considered to know how they influence open source software were; whether, Open source software is cheaper and transparent with free code; open source software is relatively secure from virus attacks and hackers compared to proprietary software; Open source software is readily available on Internet, therefore can be downloaded readily anytime; Open source software evolves faster due to multiple programmers working on same software product to add new features on software regularly; Open source software is not single vendor locked therefore multiple free community support online. The findings of this study indicate that the last characteristic of open source software not being single vendor locked combined with multiple free community support online was found to be the most popular reason on average considered by KIU staff to adopt open source software. However this is

counterattacked by lack of reliable internet services at the university coupled with limited promotional strategies employed by local online open source forums to engage these staff. The element of open source software being secure was the least motivating factor for staffs to adopt open source software. This could be explained by purpose of software use by individual staff. Majority of staff were found to focus on software that are on demand/popular on the market and not necessarily how secure the software would finally be since they are not involved in extensive software development at the university that would require response from clients on insecurity.

On studying the effect of non-preferred perceived characteristics of open source software on their adoption, the findings indicated that there is a significant correlation between the non-preferred software characteristics and open source software adoption with regard to frequency of use but not ability of use. Still on the non-preferred characteristics of open source software, they were found to have no significant influence on either ability or frequency of use of open source software by the staff. From the findings, the non-preferred characteristic of open source software not having clear channel of supply and the rival proprietary software having clear channel of supply through reinstallation, was found to be the major reason as to why the members of staff would not prefer open source software over proprietary software. This means for successful open source software adoption, there need for reliable structured supply channel of open source software together with reliable structured support for staff use of the software but this can only be achieved when the problem of software piracy is handled. From the findings on problem of software piracy, majority of staffs contented that they use cheap pirated proprietary software and they still confirmed that they don't care whether

a software is proprietary or open source so long as it can do the required job. This means that so long as software piracy gives cheap alternatives of proprietary software then adoption of open source will still be a problem.

The findings on the effect of organizational characteristics on open source software adoption.

It's evident from the findings that the existing organizational characteristics had a significant correlation with open source software both in their ability and frequency of use. However, the same findings showed that the existing organizational characteristics at that time didn't have a significant influence on open source software adoption either in terms of their ability or frequency of use. This means that much as there is a relation between open source software adoption and organizational characteristics their relationship does not cause a significant effect on level of open source software when compared with other independent variables in this study. Among factors considered in organizational characteristics include; The findings in specific terms indicate that averagely, the staff agreed to the fact that the university uses pirated proprietary software at the university, a fact which greatly hinders open source software adoption. This same fact was backed when the staff still averagely confirmed that the institution doesn't use licensed software. All these problems stem from the ICT and research policy which respondents concur that, they have either not been seen or they don't appropriately address open source software adoption gaps.

Findings to answer the research question on whether external characteristics have an effect on open source software adoption.

The findings reveal that there is a significant correlation between external characteristics and open source software adoption either inform of ability or frequency of use of open source software. In terms of level of influence on their adoption, the findings reveal that existing external characteristics have no significant influence on open source software adoption when considered as aggregated independent variables. The members generally contended that the government, national council for higher education and local open source software promoters are doing very minimal to promote open source software. Also internet services from service providers were found to be poor.

Finally on the question of developing a framework for open source software adoption, the findings confirm that from investigating the extent of individual interaction of staff with open source software forum, perceived characteristics of open source software, organizational characteristics of the institution and external characteristics as factors that affect open source software adoption, it was found that all of them had a significant relationship with open source software adoption. But only individual interaction of staff with open source software forum and preferred perceived characteristics of open source software have both a significant correlation and influence on open source software while organizational and external factors have no significant influence but significant correlation to open source software adoption. These factors can were grouped as primary (core) and secondary (important) influencers of adoption by the researcher. Those that have a significant correlation and influence on open source software adoption are grouped to be the primary factors and those that have a significant correlation but no

significant influence on open source software adoption by the staff are grouped to be secondary factors. From these findings therefore, development of an open source software adoption framework is possible.

Conclusions

This section specifically deals with conclusions based on findings of this study. These conclusions answer the main research problem, confirm whether various hypotheses in this study are accepted or rejected and illustrate the researchers' position on the main theory model of the five stages in Rogers paradigm of the innovation-decision process. The conclusions were as follows;

According to the findings in this study, the 1st Null Hypothesis was rejected (Table 16 and Table 17, sig values of 0.014 and 0.003 respectively), which meant that the level of Individual KIU staff knowledge/interaction with open source software forums/tools had a significant influence on open source software adoption. This means that the more the KIU staff interacts with open source software forums/tools or change agents, the more they are likely able to use open source software or the more frequent they can use open source software.

2nd Null Hypotheses was broken into two parts; the preferred open source software characteristics and the non preferred open source software characteristics. The null hypothesis on preferred open source software characteristics was rejected(sig values of 0.003 and 0.006 from Table 16 and table 17 respectively), leading to conclusion that preferred open source software characteristics have a significant influence on open source software adoption while the null hypothesis on non-preferred

characteristics of open source software is accepted(sig value of 0.698 and 0.385 from Tables 16 and 17 respectively) meaning that they have no significant influence on open source software adoption much as they have a significant correlation with open source software adoption.

The 3rd null hypothesis was accepted (sig value of 0.421 and 0.774 from tables 16 and 17respectively), meaning that organizational characteristics were found to have no significant influence on open source software much as they have a significant correlation with open source software.

The 4th null hypothesis was also accepted(sig values of 0.059 and 0.183 from tables 16 and 17 respectively) meaning that external characteristics generally had no-significant influence on open source software adoption.

There final conclusion on the independent variables was that for adoption of open source software to be effective, there is need for priority to be put on improving individual staff interaction with open source software forums/tools and open source software providers focusing on boosting on issues of open source software relative advantages over proprietary software. Design of open source software adoption framework can't be effective without understanding performance of proprietary software and gaps thereof. The issue of proprietary software piracy is a monster bottleneck to open source software adoption and this can only be addressed through clear policy design both at institutional or government level. The variables of organizational and external characteristics in this case come in to reinforce the individual and perceived characteristics for open source software adoption.

This study confirms roger's theoretical model of innovation adoption in open source software adoption among staff of an institution with regards to factors involved at stages one and two and with slight changes of differentiating what's critical and important(refer to fig 1). At stage two, it's evident from findings of the research that the commercial/proprietary software are quite established and advanced in their marketing strategy both at individual and institutional level, therefore deliberate strategies have to be employed by open source software developers/change agents to either exploit emerging gaps in computer technology or strategically change the entry point of open source software into the market.

RECOMMENDATIONS

Based on the findings and conclusions of this study the following recommendations are made 1st based on each hypothesis and then on proposed open source software frame work;

Basing on the results of the 1st Hypothesis, the following recommendations were proposed to improve the level of open source software adoption;

(i)There should be a deliberate open source software promotional strategy at the university linking the university staff and open source software change agents/promoters.

(ii) The online open source software promoters should develop both physical and online presence with university staff. The physical contact with university staff could be through seminars, software development competitions and trainings.

(iii) Bearing in mind that open source software is internet intensive, either reliable internet at universities should be secured or offline package supply and support to staff in Ugandan universities should be employed.

(iv) There should be deliberate efforts by government, national council for higher education and institutions of higher learning to balance proprietary and open source software in the university curriculum.

Hypothesis two

Based on the findings on this hypothesis the following are recommended if open source software adoption levels are to be improved;

(i) If Open source software is to be adopted it should well explained to staff to differentiate open source software from proprietary software and open source software should be made readily available to members of staff otherwise competition can't exist with absence of competitor.

(ii)Open source software developers should focus on new emerging trends of computer technology where proprietary software partners are not yet so much established so to assume credible competition already enjoyed by proprietary software. This could be in areas of cloud computing, mobile computing and e-learning.

(iii)Open source software developers should work hand in hand with hardware technology developers to supply software alongside hardware distributed gargets.

(iv) Credible online and physical open source software support services should be established.

(v) Commercial models for open source software should be improved and marketed.

Hypothesis three

Basing on the findings on hypothesis three, the following recommendations were made;

(i)A clear policy on open source software needs to be established at the university to promote good software use ethics and eliminate bad habits of software piracy.

(ii) Software incubation centers, staff exchange programs, together with interuniversity open source software collaboration committees need to be established by institution of higher learning.

(iii)Promotion of university communal applications like online learning management software.

(iv) Develop a research policy that encourages development of open source software applications.

(v) To establish staff refresher training courses in emerging open source software development trends.

(vi)to establish an internal university portal for dispersing new trends on open source software and internal updates on open source software projects.

(v)provision of reliable internet services by the university

Hypothesis four

Basing on the findings on hypothesis four, the following recommendations are made;

(i) Sponsorship from donor communities to promote sustainable open source software development at universities

(ii) Open source software change agents should coordinate the lobbying for open source software friendly policies at government, universities and open source software developers level.

(iii)Internationally recognized open source software certifications centers should be established in Uganda to provide substantial IT industry skills.

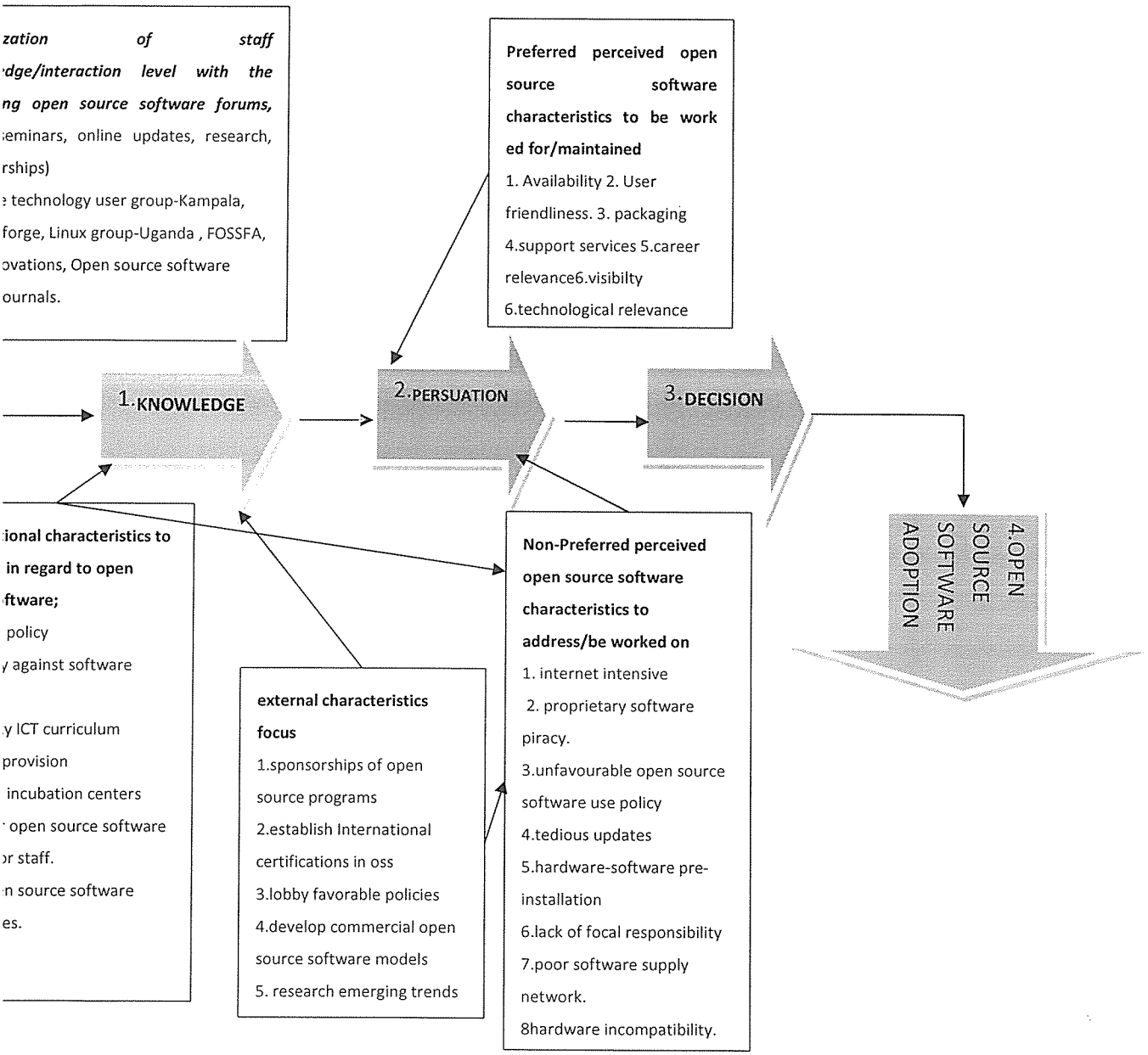
(iv)External promotion for commercial open source software models in the IT industry.

(v) Establishment of open source software coordination committees at various institutions of higher learning.

(vi) Populating relevant open source software in line with world of academia

(vii)In line with Uganda set Target 18 of Millennium development goal 8(Develop a global partnership for development), the institutions of higher learning should be part of the private sector charged with making available the benefits of new technologies especially ICT.

Fig 3: Recommended Maganda framework for open source software adoption



Legend

1. *The preferred open source software characteristics and the level of interaction of staff with open source software forums(change*

agents) are the primary influencers of open source software adoption.

2. Organizational and external characteristics are secondary influencers of open source software adoption because though they have an influence on open source software adoption but they are not a significant influencer when combined with level of staff interaction of with open source software and preferred open source software characteristics.

3. Organizational characteristics and external characteristics should mainly play a reinforcement role on eliminating the non preferred perceived characteristics and instead improve the preferred perceived open source software characteristics.

4. The non-preferred open source software characteristics have a negative effect on persuading staff to adopt those software unless worked on by organizational and external influence to turn into preferred characteristics that positively impact on open source software adoption.

Recommendations for further research

1. Stakeholders' analysis of open source software adoption in Uganda; Challenges and way forward.

2. Evaluation of Maganda frame work for open source software adoption in institutions of higher learning.

3. Framework development for cloud computing adoption in Ugandan universities

4. Framework for FOSS development in Uganda IT industry

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Appendix I

Transmittal letter

KAMPALA
INTERNATIONAL
UNIVERSITY

EXPLORING THE HEIGHTS

a Road, Kansanga
... Kampala Uganda

COLLEGE OF HIGHER DEGREES AND R... ARCH (CHDR)
OFFICE OF THE HEAD OF DEPARTMENT, APPLIED SCIE... D T... CHNOLOGY

Date: 4th July 2012

Dear Sir/Madam.

RE: REQUEST FOR MAGANDA EVANS TABI... A... 1/6036/72/DU TO CONDUCT RESEARCH IN YOUR ... ITU... ION

The above mentioned is a bonafide student of Kam... International University pursuing **Masters of Science in Systems Softwar... ngineering**

He is currently conducting a research entitled "A... r **Effective Open Source Software Adoption in a High... ution in Uganda, A case of Kampala International Un...**"

Your Institution has been identified as a valu... information pertaining to his research project. The purpose of ... quest you to avail him with the pertinent information he may ne...

Any information shared with him from your Insti... ated with utmost confidentiality.

Any assistance rendered to him will be highly appr...

Yours truly,

Businge Phelix Mbabazi
Head of Department, Applied Science and Technolo...

NOTED BY:
Dr. Sofia Sol T. Gaite
Principal-CHDR

Appendix II

Research Instrument

KAMPALA INTERNATIONAL UNIVERSITY

COLLEGE OF HIGHER DEGREES AND RESEARCH

MASTERS PROGRAM

RESEARCH INSTRUMENTS

Questionnaire

Sample Questionnaire for collecting information on extend to which individual characteristics of staff, Open Source Software perceived characteristics by staff, organizational characteristics of the university and other external factors influence OSS adoption in Higher education institutions in Uganda.

Dear Participant,

I am a candidate for masters of Software engineering at Kampala International University currently carrying out research on development of open source software adoption framework. You are kindly requested to participate in this research to develop a framework for Open source software adoption framework in institutions of higher learning in Uganda. The questionnaire seeks to gather information about the extend to which individual characteristics of university staff, perceived characteristics of Open source software by staff, organizational characteristics of the university and other external factors affecting OSS adoption in institutions of higher learning in Uganda and thus develop a frame work that can be used to effectively adopt Open source Software in institutions of higher learning. Please ***note*** that: There are no ***correct*** or ***incorrect*** responses, so please kindly provide the most appropriate information as indicated in

the questionnaires and please do not leave any item unanswered. All the information gathered from this questionnaire will be ***totally confidential*** and the strictest confidentiality and anonymity shall be preserved. The results of a statistical analysis of the data from this study will be used to develop an OSS adoption framework for institutions of higher learning in Uganda.

Yours faithfully
Maganda Evans Tabingwa
Master's Degree Candidate

INFORMED CONSENT

In signing this document, I am giving my consent to be part of the research study that will focus on development of frame work for open source software adoption in institutions of higher learning in Uganda. I shall be assured of privacy, anonymity and confidentiality and that my name shall not be publicized in the final report nor will there be any cross-references made that can link the results of the questionnaire to me. I have been informed that the research is voluntary and that the results will be given to me if I ask for them.

Initial: _____

Date: _____

FACE SHEET:

Code#..... Date received by respondent.....

SECTION A: DEPENDENT VARIABLE: Open Source Software Adoption (i.e knowledge and practical use of OSS).

A. KNOWLEDGE/ABILITY OF USE/FREQUENCY LEVEL OF USE OF OPEN SOURCE SOFTWARE.

Are you aware of existence of the following software under the following categories? Please tick(√)the correct answer. **Where frequency of use is asked for rating, please, tick the correct number that corresponds to your answer as per the following range;**

1= I have ever used it before but don't use it anymore

2=I use it once in a while

3=I use it frequently

Where ability of use is asked please tick corresponding number to your answers as follows;

1=I'm not well acquainted with the use of this software

2=I'm comfortable with the use of this software

3=I'm very well versed with the use of this software

A						
1.0 Office software (OpenOffice Vs Microsoft Office)						
	OpenOffice			**Microsoft Office**		
1.2 Ability of use	1	2	3	**1**	**2**	**3**
1.3 Frequency of use	1	2	3	**1**	**2**	**3**
1.4 Do you have any preference of use for	**(1)Open Office**			**(2)Microsoft Office**		

	Open Office or Microsoft Office?(tick preference)	
1.5	**Please list reason/s of preference**	**OpenOffice**	**Microsoft Office** ....
1.6	Are you aware of **any other Office software** in existence?	**List them here if any** .....
1.7	If at all you've listed any above, list those you have **personally use/d**	**List them here if any** .....

2.0 Web server solution software packages(WAMP & XAMPP)						
	WAMP			**XAMPP**		
2.2 Ability of use	**1**	**2**	**3**	**1**	**2**	**3**
2.3 Frequency of use	**1**	**2**	**3**	**1**	**2**	**3**
2.4 Do you have any Preference of use for WAMP or XAMPP?(tick preference)	**(1)WAMP**			**(2)XAMPP**		
2.5 Please list reason/s of preference	**WAMP**			**XAMPP**		
2.6 Are you aware of **any other Web server solution software** in existence?	**List them here, if any**					
2.7 If at all you've listed any above, list those you have **personally use/d**	**List them here, if any**					

3.0 Programming languages (VB.NET/VB vs Java)						
	VB.NET/VB			JAVA		
3.2 Ability of use	1	2	3	1	2	3
3.3 Frequency of use	1	2	3	1	2	3
3.4 Do you have any Preference of use for VB.NET/VB or JAVA?(tick preference)	(1)VB.NET/VB			(2)JAVA		
3.5 Please list reason/s of preference	VB.NET/VB			JAVA		
3.6 Are you aware of **any other Programming languages** in existence?	**List them here**					
3.7 If at all you've listed any above, list those you have **personally use/d**	**List them here**					

4.0 Operating Systems (Windows OS (7,xp) Vs Linux OS)						
	Windows OS			Linux OS		
4.2 Ability of use	1	2	3	1	2	3
4.3 Frequency of use	1	2	3	1	2	3
4.4 Do you have any Preference of use for Windows OS or Linux OS?(tick preference)	(1)Windows OS			(2)Linux OS		
4.5 Please list reason/s of preference	Windows OS			Linux OS		
4.6 Are you aware of **any other operating systems** in existence?	**List them here**					

4.7 If at all you've listed any above, list those you have **personally use/d**	**List them here**					
5.0 Sakai Collaboration Learning Environment, Open Academic Environment and **Moodle**(Modular Object-Oriented Dynamic Learning Environment)						
	Sakai			**Moodle**		
5.2 Ability of use	**1**	**2**	**3**	**1**	**2**	**3**
5.3 Frequency of use	**1**	**2**	**3**	**1**	**2**	**3**
5.4 Do you have any Preference of use for Sakai or Moodle ?(tick preference)	**(1)Sakai**			**(2)Moodle**		
5.6 Are you aware of **any other Online learning environment** software in existence?	**List them here**					
5.7 If at all you've listed any above, list those you have **personally use/d**	**List them here**					
6.0 Cloud computing						
6.1 Are you aware of cloud computing online services existence? **(1)Yes (2)No**						
6.2 Please tick any of the following Google products/tools you may have used **1. Google Docs 2.Google Calendars 3. Google Sites 4.Google groups 5.Google translate 6.Google scholar**						

SECTION B: INDIVIDUAL CHARACTERISTICS OF STAFF (INDIVIDUAL BACKGROUND INFORMATION, KNOWLEDGE/INTERACTION WITH EXISTING OPEN SOURCE SOFTWARE FORUM/TOOLS)

B1 INDIVIDUAL BACKGROUND INFORMAION OF STAFF

7.1 How old are you? (Please tick correct answer) (1) Below 25 years (2) 26 – 39years (3) 40 – 54years (4)55years and above		
7.2 What's your gender**?** (please tick correct answer)	**Male**	**Female**
7.3 What position/s do you hold at the university?	**1**.....	**2**.....
8.0 TRAINING BACKGROUND/INTERESTS		
8.1 What are your academic qualifications?(please tick correct answer/s) 1. Diploma in.....2. Bachelor in..... 3. Masters in.....4. PhD in.....		

8.2 Do you possess any other professional qualifications? e.g MCSE, CCNA, LPI (Please tick correct option)	**Yes**	**No**
8.3 If your answer to 8.2 is Yes, kindly list in the space provide below the ICT qualifications you possess;		
8.4 Do you intend to enroll/are you enrolled for ANY ICT professional course?	**Yes**	**No**
8.5 If your answer is yes to 8.4, list below ICT professional courses you are enrolled into/you intend to enroll into. 1.....2.....3.....		
8.6 Do you have any informal self software training you have undertaken?	**Yes**	**No**
8.7 If Yes to 8.6, please kindly list software you have trained yourself/informally been trained for purpose of acquiring relevant skills 1.....2.....3.....		
8.8 Please list in space provided the type of software you intend to learn/intend to be trained in; 1.....2.....3.....		

B2. INDIVIDUAL KNOWLEDGE/INTERACTION WITH EXISTING OPEN SOURCE SOFTWARE FORUM/TOOLS. In the table, ticking the following means

Yes=I'm aware of this particular open source software forum/site existence

No=I'm not aware of this particular Open source software forum/site existence.

1=I rarely use this particular forum/site

2=I use this particular forum/site once in a while

3=I use this particular forum/site often

		Your awareness of existence of open source software forum/tools Yes(please tick either yes or No in this column depending on your answer) ←		**Your Frequency of interaction with open source forum/tools (Please tick one option corresponding to your correct answer)** ←		
9.1	**Linux Group-Uganda (LUGs)**	**Yes**	**No**	**1**	**2**	**3**
9.2	**ICT-INNOVATIONS (provision of Linux Administration Certifications, innovative africa foss applications)**	**Yes**	**No**	**1**	**2**	**3**
9.3	**Sourceforge**(Largest open source software applications and directory)	**Yes**	**No**	**1**	**2**	**3**
9.4	**Free Software and Open Source Foundation for Africa(FOSSFA)**	**Yes**	**No**	**1**	**2**	**3**
9.5	**Google technology user group-kampala**(user groups for people interested in google's developer technology).	**Yes**	**No**	**1**	**2**	**3**
9.6	**Open Source Software Online Journals**(e.g International journal of open source software & processes,	**Yes**	**No**	**1**	**2**	**3**

	Directory of Open Access Journal(DOAJ)).					
9.7	**East African Centre for Open Source Software –Uganda (Awareness and FOSS skills)**	**Yes**	**No**	**1**	**2**	**3**
9.8	**Blogs**	**Yes**	**No**	**1**	**2**	**3**
9.9	**Affiliation to other OSS community**	**Yes**	**No**	**1**	**2**	**3**

SECTION C: PERCEIVED CHARACTERISTICS OF OPEN SOURCE SOFTWARE BY STAFF

On general basis of open source software(e.g Linux OS,open office, mysql, java,wamp and OTHER Open source software general knowledge) and proprietary software(windows os, Ms office, vb. Net, xampp and other general knowledge), tick the best response that corresponds to reason why you may prefer/not prefer open source software over proprietary software based on these categories;

1=I Strongly Disagree 2=I Disagree 3=I Agree 4=I Strongly Agree

Why you may prefer open source software over proprietary software

17.1 open source software is cheaper and transparent with free code	1	2	3	4
17.2 open source software is relatively secure from virus attacks and hackers compared to proprietary software	1	2	3	4
17.3 open source software is not single vendor locked therefore multiple free community support online	1	2	3	4
17.4 open source software evolves faster due to multiple programmers working on same software product to add new features on software regularly	1	2	3	4
17.5 open source software is readily available on Internet, therefore can be down loaded freely, anytime.	1	2	3	4
Why you may not prefer open source software adoption over proprietary				
18.1 I have insufficient skills in open source software products use	1	2	3	4
18.2 open source software is not very popular in our day to day activities	1	2	3	4

18.3 open source software is Internet intensive and yet daily reliable Internet is unaffordable	1	2	3	4
18.4 open source software continuous evolution makes it sometimes incompatible with existing hardware	1	2	3	4
18.5 pirated proprietary software still makes 'proprietary software cheaper' compared to open source software, thus I still work with proprietary software because it's a cheaper option	1	2	3	4
18.6 proprietary software are a common requirement on job market compared to open source software	1	2	3	4
18.7 majority of open source software are not included in normal university curriculum.	1	2	3	4
18.8 I'm not bothered with proprietary or open source software so long us the software does what I want and is a required skill on my job	1	2	3	4
18.9 Majority of computer suppliers, supply computers with pre-installed proprietary software platforms like windows and not open source like Linux.	1	2	3	4

SECTION D: ORGANISATIONAL CHARACTERISTICS OF THE UNIVERSITY

Please tick the correct answer in the following table

1= I Strongly Disagree 2=I Disagree 3= I Agree 4=I Strongly Agree

Yes =yes I agree with the statement

No=No I don't agree with the statement

19.1 Does your university have an open source software user/procurement policy	Yes	No
19.2 Does your university have a clear software research	Yes	No

policy				
19.3 Does your university have a software incubation center	Yes			No
19.4 Do you have regular software refresher training courses	Yes			No
19.5 Does your university use licensed software	Yes			No
19.6 Do you believe your university use pirated software	Yes			No
19.7 To what extend do you agree that your university determines the software you use on your personal computer while at work?	1	2	3	4
19.8 To what extend do you agree that you have an influence on software installed on university computers	1	2	3	4
19.9 Is your university an active member to any active external software community in areas of software development	Yes			No
19.10 If Yes to 19.9, have you or your students delivered finished software products/research in to this organization/community	Yes			No
19.11 To what extend do you believe that the university provides sufficient funding for software needs	1	2	3	4
19.12 To what extend do you believe your university work load negatively affects your level of innovation.	1	2	3	4

SECTION E: External factors that influence Open source software adoption

Please tick the correct answer in the following table

1= I Strongly Disagree 2=I Disagree 3= I Agree 4=I Strongly Agree

Yes =yes I agree with the statement

No=No I don't agree with the statement

20.1 Does your university provide reliable Internet connectivity?	1	2	3	4
20.2 To what extend does this affect your open source software adoption	1	2	3	4
20.3 Do you think the government is doing enough towards open source software adoption?	1	2	3	4
20.4 Do you think the national council for higher education is doing enough to promote open source software adoption?	1	2	3	4
20.5 Do you believe open source software champions/promoters in Uganda are doing enough to promote open source software?	1	2	3	4
20.6 Do you have Interuniversity software collaboration committees?	Yes			No