IMPACT OF HIGHER LEARNING INSTITUTIONS EXPANSION ON THE ADEQUACY OF NETWORK INFRASTRUCTURE IN DEVELOPING COUNTRIES: A CASE OF ICT PLANNING AT THE UNIVERSITY OF DODOMA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PROJECT MANAGEMENT OF THE OPEN UNIVERSITY OF TANZANIA

2016

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the Open University of Tanzania a dissertation entitled "**Impact of Higher Learning Institutions Expansion on the Adequacy of Network Infrastructure in Developing Countries: A Case of ICT Planning at the University of Dodoma**" in partial fulfillment of the requirements for the degree of Master of Project Management (MPM) of the Open University of Tanzania.

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Dr. Cosmas B.M. Haule

Supervisor

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Date

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DECLARATION

I, **Ahmed Salim,** do hereby declare that this dissertation is my own original work and that it has not been presented and will not be presented to any university for similar or any other degree award.

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Signature

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Date

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DEDICATION

This research is dedicated to my father Salim Zagar and Mother Furaha Mwaipaya for their constant love, encouragement, endless support and wisdom towards my academic excellence. These are things I will never be able to repay. God Bless You.

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I wish to express my sincere gratitude to almighty God for care and health He offered to me in completion of this work and living as a whole. Also I dedicate my thanks to all individuals and institutions that in one way or another contributed to the successful completion of this work.

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I greatly acknowledge the financial and moral support offered to me by my family especially my dear mother Furaha Mwaipaya, father Salim Zagar, other family members and my classmate for the courage he/she gave to me during the whole process. Finally, I acknowledge all respondents (people) who played a big role in data collection.

ABSTRACT

The study was conducted at the University of Dodoma in 2014 with the aim of investigating the expansion of Higher learning institution and the adequacy of network infrastructure a case of ICT planning at the Dodoma University. A total of 183 respondents (156 students, 17 IT personnel and 10 planners from the whole university) were interviewed using a case study design. Observation and documentary review guides were used to obtain information that could not be obtained by use of self administered questionnaire and the interview guide. The results reveal that the expansion of university affect network infrastructure and the running costs of the ICT department. The study found out that the stated network infrastructure development objectives were not met as expected. This was mostly caused by the fact that most of the stakeholders were not aware on the whole process of infrustructure planning and university expansion. For instance most IT staffs were not fully invloved to play their part and give expartism on the ICT infrustructure planning results into skipping most of the required inputs from initial stage. On the process from initial infrustrure planning, there was a need to involve all the stakeholders, since most problems mentioned above were the results of some stakeholders being not invloved on planning, designing and decision making. On the other hand, the government should play its part by providing the required budget submitted to them from this higher learning institutions, increasing and maintaining this, will ratify the situation or condition and improve more.

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LIST OF ABBREVIATIONS

ATICS	African Tertiary Institution Connectivity Survey
CNMS	College of Natural Sciences
CoES	College of Earth Sciences
EPSTEL	Environmental, Political, Informatics, Social, Technological, Economic and Legal
EUI	European University Institute
IBM	International Business Machinery
ICT	Information and Communication Technology
IT	Information Technology
MoEVT	Ministry of Education and Vocational Training
PEST	Political, Economic, Social and Technological
PPP	Public Private Partnership
STEER	Socio-cultural, Technological, Economical, Ecological and Regulatory factors
SWOT	Strength, Weakness, Opportunities and Treats
UDOM	University of Dodoma
UNESCO	United Scientific and Cultural Organization
URT	United Republic of Tanzania
WB	World Bank

CHAPTER ONE

INTRODUCTION

1.1 Overview

This study seeks to investigate the expansion of higher learning institution and network infrastructure planning, what were the challenges and proposing solutions to those challenges. Since independence, Tanzania higher learning institutions, University and Colleges have been expanding mostly in construction of buildings including administration blocks and classes while ignoring the Development of ICT infrastructure.

1.2 Background to the Problem

Given the steadily expanding demand for higher education in developing countries, there is an ever-increasing demand for higher education, as more students require access for further study. Already millions of students in developing countries qualified to study at a university are unable to do so, as existing university do not have the capacity to accommodate them (Grobler, 2013). Problems of quality and lack of resources are compounded by the new realities faced by higher education, the most of which is expansion, as higher education institutions battle to cope with ever-increasing student numbers. However, as noted by Peril and Promise (2000) responding to this demand without further diluting quality is an especially daunting challenge.

Massive higher education expansion in the world's four largest developing economies Brazil, Russia, India, and China, known as the BRIC countries is having a

significant impact on the world supply of university graduates, including greatly increasing available cadres of engineers and computer scientists. This expansion may change the locus of future development in the global knowledge economy (Carnoy *et al*., 2013).

Under globalization era a world stands as a village, so it becomes difficult to run university without having well equipped ICT infrastructure. The expansion of higher learning institutions in Tanzania do not meet current higher learning population needs, costs and the quality of ICT services used in teaching function. ICT centre is important engine for bringing development but it must be supported by a sound policy and planning. Economic, technological and knowledge gaps will be addressed if Tanzania and other Africa countries develop ICT centres that offer consultation services to the community and facilitate training in higher learning institution.

The term Information and Communication Technology (ICT) refers to forms of technology that are used for communication and to transmit, store, create, share or exchange information. This broad definition of ICT includes technologies such as: radio, television, video, telephone, computer and network hardware and software; as well as equipment and services associated with these technologies, such as electronic mail, text messaging and radio broadcasts (MoEVT, 2007). ICT involves the use of hardware, software networks and media for the collection, storage, processing, transmission and presentation of Information (Voice, data, text, images) as well as related services (WB, 2013). Development and application of ICT in African institutions of higher learning is critically important if the continent is to reduce the knowledge, technological and economic gaps between itself and the rest of the world

(Farrell and Shafika, 2007). ICT has become a key element in the way teacher teaches and students learn. In education, the delivery of knowledge using ICT's has influenced the design of various curricula programmes nationally and globally in launching of different educational programmes. Through computer network, learners were able to communicate with the instructor on the material and could discuss assignments involved. In this process learners were able to attend lectures on line (Gay & Lantini, 1995). The forces that have driven institutions of higher learning to adopt and incorporate ICT in teaching and learning include: greater information access, greater communication synchronous and asynchronous learning, increased cooperation and collaboration, cost effectiveness and pedagogical improvement (Surry and Ely, 2001 cited by Twinomujuni, 2011).

With the exception of South Africa, Mauritius, and most of North Africa, African university are seriously constrained in the use of ICT by a lack of computer stations and a lack of access to affordable high-speed Internet connectivity. Indeed, the 2006 African Tertiary Institutions Connectivity Survey (ATICS) summed up the situation as too expensive, and poorly managed (Farrell and Shafika, 2007).

At the University of Dodoma, the number of academic programmes has increased from 17 undergraduate and one graduate degree programmes in 2007/2008 to 78 undergraduate and 21 graduate degree programmes in 2010/2011 with increased academic programmes coupled with increased enrolment (UDOM Rolling strategic plan, 2012). The demands placed to accommodate larger numbers of students and to serve expanding functions have resulted in reforms such as curriculum development, teaching methodologies and distance learning in higher education in many countries

(Okioga *et al*., 2012). Due to this, reliable ICT infrastructure is required in order to run the university effectively. Currently, the level of ICT applications in education sector in Tanzania is still inadequate with the whole tertiary and higher education facing a number of bottlenecks due to the limitation of ICT infrastructure and specific competent workforce (Swarts and Wachira, 2010).

The University of Dodoma comprises with large number of students and staff compared to network infrastructure it has. And this number of student will increase until it reaches 40,000 as it was planned by the government. Increase in number of students will eventual lead the expansion of capacity buildings at university. That's why researcher investigates the expansion of higher learning institution and the efficiency of network infrastructure.

1.3 Statement of the Problem

The University of Dodoma are expected to have proper network infrastructure planning for better delivery of ICT services and cope with large numbers of students enrolled. Also, we expected them to have network infrastructure that will provide the bridge between infrastructure requirements and the university's current and future objectives, such as facilitate innovative thinking, security and the unification of objectives and results. In addition, we expected the infrastructure to provide the insight needed to make efficient use of technology without compromising any university integrity. However, the situation at University of Dodoma is uncalling as the ICT devices used such switches are outdated with narrow bandwidth to accomodate the six colleges of the university which resulted poor network services and inadequate ICT services at the university (Matogoro, 2011). Apart from that, the

minimal budget allocation in ICT directorate as well as the low priority given ICT infrastructure are contributing to poor ICT services delivery. The university trying to resolve the issue by using fiber backbone and changing the Internet Services Provider (ISP).

Despite the efforts done by the University of Dodoma (UDOM) to improve the network infrastructure and ICT services, still the problem exist due to poor network architecture planning and design. Therefore, this study investigated the expansion of higher learning institutions with the efficiency of network infrastructure whereby the challenges that lead to poor network services will be exposed and the suggestions on how solve the problem faced network services will addressed since the current situation of network at the university of Dodoma is not reliable.

1.4 Research Objectives

1.4.1 General Objective

The general objective of the study was to assess the impact of higher learning institutions expansion on the adequacy of network infrastructure in developing countries.

1.4.2 Specific Objectives

(i) To review the nature of network infrastructures development objectives at UDOM.

(ii) To determine the status of network infrastructure development implemented at UDOM

(iii) To examine manners in which plans on ICT infrastructures are carried out at UDOM.

(iv) To assess how ICT enhance information flow networks at UDOM.

1.5 Research Questions

(i) What is the nature of network infrastructure development objectives at UDOM?

(ii) What is the status of network infrastructure implemented at UDOM?

(iii) How the plans in ICT are carried out at UDOM?

(iv) Is there any feedback mechanism for ICT development at UDOM?

1.6 Significance of the Study

The study was aiming to review the nature of network infrastructures development objectives which helps to develop or acquire new tools or enhance existing tools to enable efficient and effective support of the network infrastructure at the University

In addition to that, knowing the status of network infrastructure development at the university helps the management to provide highly, reliable, scalable, secure and manageable network infrastructure that provide for coverage of services.

Moreover, this study is significance for planners of higher learning institutions to see how the manners in which plans in ICT are carried out. Hence, management of higher learning institutions will be in position to identify both technical and administrative bottlenecks and how to deal with them on having efficiency network infrastructure. Finally the assessment of ICT to enhance the information flow enable

to provide comprehensive information technology support to address the university technology concern in a timely professional manner.

1.7 Scope of the Study

This study focused on proportionality of both students (19671) and staff (1361), and development of ICT center in network infrastructure at the University of Dodoma. There is a demand of having ICT center at the University of Dodoma due to the peculiarity of the institution as its biggest university comprises of six semi-autonomous colleges.

1.8 Limitations of the Study

Possible limitations of the study include:

(i) Some respondents may not be willing to provide requested data.

(ii) Questionnaire respondents may take too long to return the filled questionnaires; some may not be filled and returned or they may not be fully filled.

(iii) Officials earmarked for interview may not be available for interview due to their busy work schedules.

(iv) Some respondents do not participate in the study fearing of researchers exposing their names.

Measures to be taken to address the anticipated limitations are:

(i) Using multiple sources of data collection helped to address the limitations of individual methods of data collection.

(ii) To encourage cooperation of respondents to feel and return questionnaires, whereby the purpose of the study was clearly explained to them, stressing the importance of the study for education or policy and national development.

(iii) Reminders in terms of cell phones and physical ways are to be made so that all respondents fill and return the questionnaires and all scheduled interview are carried out.

(iv) Questionnaires should be clearly written by avoiding complex terms and should not be too long; such measures will enhance the response rate.

(v) Make sure respondents names are not disclosed to the public for their own security and identity concealed. This promise when stated well will promote or enhance respondents' participation in the study and that nobody will be associated with any statement or data provided (Creswell, 2007).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section gives the literature reviews related to the objectives of the study. These variables are nature of network infrastructures development objectives (ICT Policy defined and ICT Strategic Planning), manners in which plan of ICT infrastructure are carried out, status of network infrastructure feedback mechanisms and theoretical framework.

2.2 Nature of Network Infrastructure Development

The Network infrustructure development depend on policy and strategic planning,where by planning is done on both formal and informal, formal everything is documented and informal nothing is written down and uses information within and outside the organization, This process help to reduces uncertainty, overlapping and wasteful activities, give directions to all management functions, and establishes goals and standards used in controlling (Robbins *et al*., 2003).

Various business analysis techniques are used in strategic planning. These include SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats), PEST analysis (Political, Economic, Social, and Technological), STEER analysis (Socio-cultural, Technological, Economic, Ecological, and Regulatory factors), and EPISTEL (Environment, Political, Informatics, Social, Technological, Economic and Legal). ICT strategic planning, whose outcome is an ICT policy and master plan, makes ICT responsive to the organizational vision and mission, providing systematic methods of

implementation through organizational ICT policies and creating ownership of projects hence leading to sustainability and long term returns from ICT (Tusubira and Mulira, 2004).

There is need for an enabling environment for Public-Private Partnerships (PPP) in ICT development (Kenya ICT Policy, 2006). The development of plans' doesn't necessarily equate with implementation and results on the ground. In most cases implementation remains very dependent on the support of partners from the donor community and the private sector. Indeed, some countries have set up mechanisms specifically to attract investment in the development of ICT in education and through which to involve stakeholders in setting priorities and allocating resources (Farrell and Shafika, 2007).

Organization can introduce new applications to the network or increases in workload without anticipating how those changes will affect overall network performance. As a result, you may find your organization operations continually limited by your network (IBM Corporation, 2007). Organizations must approach network outages and performance issues differently to minimize or prevent such occurances. Outages can typically be reduced by using redundancy mechanisms, such as hardware and software with high availability built into their design,deployment and connectivity.

To further improve network and system uptime, organization need to ensure proper configuration of the protocols that react to outages and ensure that their network monitoring system notifies the right people at the right time (Brocade Communications Systems, 2009).

According to the frame group pty limited (2013), ICT strategic planning when it's well formulated and implemented provides three important benefits:

(i) It aligns technology with your business goals, enabling a contribution to your organization's strategic objectives.

(ii) It enables ICT systems to be fully integrated across each department, which in turn allows for organization-wide management of your ICT environment. The needs of your customers are fully considered and satisfied.

(iii) It builds a strong relationship between your business and ICT departments, which secures commitment to the ICT strategy since all key stakeholders are involved in the process.

2.2.1 ICT Policies in Institutions of Higher Learning

Policies offer general guiding statements such that out of each policy, it is possible to establish many more focused guiding statements known as programs, which are normally more specific unlike policies (Ngailo, 2012). ICT policy and practice at the university was clearly affected by national policies and practices. For example in Zimbabwe, where the recent national turmoil has resulted in significant non-operation at Zimbabwe university and difficulties in retaining ICT staff there (Cgnet, 2009).

For the successful integration of ICT in Education, it is acknowledged that government should create the necessary guiding frameworks (polices and strategies) both at the national and sector (education) levels. The ICT in Education policy should be linked to the national ICT policy and vice-verse. In turn, national ICT

policies should be rooted in the countries overall development plan (Swarts and Wachira, 2010).

2.3 Status of the Network Infrasturcture

Network infrastructure provides the communication path and services between users, processes, applications, services and external networks/the Internet.Communication is transfer of information from one person to another, whether or not it elicits confidence. But the information transferred must be understandable to the receiver. Communication is giving, receiving or exchanging ideas, information, signals or messages through appropriate media, enabling individuals or groups to persuade, to seek information, to give information or to express emotions (Barnlund, 2008).

Intranet and database systems are key components in the formation of ICT infrastructure, and hence their existence enhances greater Management control by enabling departments in university and their compuses to have greater access to information needed for management processes. This will enable them (management) to function more effectively and efficiently and since projections will be more accurate or now available, university managements can make long-term strategic plans during their management processes (Nyandiere, 2007 Cited by Ujunju *et al*., 2012).

A poorly performing network can cost money,customers and productivity, damaging both your bottom line and your competitive standing. A network is a dynamic system, almost an organism in its own right. Optimizing it can be a significant challenge. Where do you start?, What if the changes you institute actually make

matters worse? (IBM Corporation, 2007). Providing the infrastructure necessary to access ICT networks can, however, be expensive and complex. One of the challenges for developing countries is to select the technology that is most appropriate to their needs and that local populations have the capacity to use effectively (Microsoft White Paper, 2004).

According to strategic plan (2014) of Grasgow University in England invest heavy to ensure University's data communications and Network Infrastructure provides the connectivity, bandwidth, reliability and security required to support the wide range of services and applications which currently depend on it and new services as they develop in contrary to this Tanzania university lack the resources and appropriate Network infrastructure which lead to poor services when the university expand. The effective Network infrastructure require availability of equipments, supplies of computers and their proper maintanance including other accessories (Khan *et al*., 2012). The development of network infrastructure in any country is dependent on the stability of electricity. On the other hand, most of the places especially rural area do not have electricity and in urban area where electricity is availabale there is a tendency of frequently power outage this may cause damages to many ICT equipments.

There is a temptation these days to equate technology with computers and the Internet. As pointed out earlier, there is still an important place for other technologies, depending on how they will be used. The application of each technology falls over a wide spectrum, from the simplest to the most sophisticated. It is important, therefore, to identify the most appropriate, cost-effective, and

sustainable technology and level of application for the different educational objectives. Then the whole prerequisite hardware infrastructure needs to be in place with the supporting elements, such as electricity, maintenance, and technical services (UNESCO and the Academy for Education Development, 2002).

2.4 Theoretical Frameworks on ICT

2.4.1 IT Implementation Theory

The model is based on the organizational change, innovation, and technological diffusion literature. The purpose of the theory is to offer a directing and organizing framework for ICT implementation research (McLaughlin, et al, 2000). Mathieson, (1991) stage model comprises six stages, namely initiation, organizational adoption, adaptation, acceptance and adoption, routinization, and infusion.

Thus, the model covers an implementation process from the scanning of organizational needs to a full and effective use of the technology in daily practice. The theory also identifies five contextual factors, which impact on processes and products in each implementation stage: the characteristics of the user community, the organization, the technology being adopted, the task, and the organizational environment.

It can be true that, any organization whether public or private must adopt IT and use it. Such an organization must adopt six stages, namely initiation, organizational adoption, adaptation, acceptance and adoption, routinization, and infusion in order to fulfils its goals.

2.5 Manners in which Plans of ICT Infrastructure are Carried Out

The implementation of an information system in an institutions should consider; data requirements, security, availability of software and hardware, and availability of trained personnel with relation to cost (Catholic Relief Services, 2011).

2.5.1 Budget/ Cost of ICT Devices and Implementation

For the betterment of the network infrastructure the organization should inquire various costs such as; Cost of Bandwidth, Cost of Maintenance of equipment and applications, Cost of software licenses, Cost of replacement of equipment (A computer bought today must be replaced in three to five year), Retain for ICT professionals (Generally at levels that are likely to be higher than average because of competition for the same human resource by private sector) (Tusubira and Mulira, 2004).

The issues each country faces in developing their Network infrastructure vary, but many countries identified the cost of equipment and bandwidth as a major barrier (UNESCO, 1999). It was noted that the Government of Tanzania can only provide a minor part of the funding required for the ICT in education programme. This component is mainly dependent on donor support (Swarts and Wachira, 2010).

2.5.2 Skills Development in ICT

Rwanda's ICT development and transformation into a knowledge-based economy, there must be programs designed to train ICT personnel and campaigns to attract more Rwandans in the field of ICT, Institutions of higher learning such as TVET (Technical, Vocational and Training) and University as well as the private sector can

collaborate to ensure the development of industry specific skills with the aims to increase home grown ICT expertise that meets national, regional, and global ICT needs (NICI, 2015).

The MoEVT recognizes the need for continuous training programmes to build sufficient capacity among staff and other stakeholders. ICT training will range from ICT literacy and technical development skills to the use of ICT in management and administration. Special efforts will be made to train teachers and educators in ICT content development, trouble-shooting, and pedagogical uses. Given the wide applicability of ICTfor training and professional development, ICT-enabled training methods will be fully explored, including distance education, e-learning, m-learning and blended learning. Training will be offered on a continuous basis to enable staff and other stakeholders to keep up to date with technological and pedagogical developments (MoEVT, 2007).

ICT skills are vital to enabling individuals and organizations to leverage the full potential of information and communication technologies.Yet in many parts of the developing world,relatively few users have the skills to utilize ICT effectively.Fewer still have the expertise to develop ICT products or provide critical IT services. A shortage of skilled ICT workers will make organizations reluctant to invest in ICT, thereby curtailing demand for domestic ICT products and services and leaving fewer opportunities for entrepreneurs and domestic ICT firms. A chronic shortage of skilled ICT workers will impair a country's competitiveness not only in the ICT sector-one of the fastest growing areas of the global economy-but in many other more traditional sectors as well (Microsoft white paper, 2004).

Tanzania is not the only country with insufficient numbers of skilled and experienced experts in ICT and in other professions that rely on ICT. It is therefore necessary to view Tanzania's human capital needs in the global context (Tanzania ICT Policy, 2003).

2.5.3 Technical Support

In a University of Cape Town there is a good system of supporting staff and students regarding the ICT technical problems, Technical support are categorized in three different parts.First level support- All calls to the IT Helpdesk are logged using a call management system called HEAT, which facilitates the tracking, reporting and resolution of calls.Second level support- If a helpdesk consultant is unable to assist a caller over the phone, and it is determined that a desktop visit is required, the call is referred to the second-level (on-site) support team.Third level support- Certain types of calls, e.g. requests for more technical systems administrative functions and support, are routed directly to the Technical Support Services team (University of Capetown:Student & Staff Support, 2014).

ICT Services comprises several teams working together to provide an ICT service for its University customers. Responsibilities range from maintaining and developing the network infrastructure necessary to support ICT systems, to providing technical support for existing systems and expertise and resources for new developments (University of the West Scotland: ICT Services, 2013).

2.6 Feedback/Reporting Mechanisms in Institutions of Higher Education

Feedback is essential to the working and survival of all regulatory mechanisms found throughout living and non-living nature, and in man-made systems such as

education. Feedback is essential for rational decision making and is necessary ingredient of an administrative climate to attaining organizational objectives, it is all about the activities and results of performance of each individual as well as of groups or departments.Thus the person will want to understand what information is being obtained about him, how it will be used and why (Warner and Havens, 1966).

Effective communications help to establish clear expectations for employees and, perhaps surprisingly, for customers as well. For employees, clear expectations will convey how their performance will impact the company and give them an indication of what they need to do to achieve positive feedback (Richards, 1980).

Effective communication in an organization increases productivity, decreases employee turnover and improves office atmosphere. Whether a supervisor or regular employee at the organization, the better you communicate--as difficult as it might be at times--the better working relationships you'll have (Holt, 2009). For the higher learning institutions the mechanism like Questionnaires, Staff representatives, Discussions and students staff liason committees are the effective wa of giving feedback (Brennan and Williams, 2004).

2.7 Knowledge Gaps

As observed from the related literature from various scholars and past researchers collected from secondary sources i.e. textbooks, magazines, internet and journals. Network infrastructure in developing countries is not efficiency in some institutions of higher learning. For the case of Cost/Budget many studies indicate ICT equipment costs are very high and Budget allocation in ICT directorate in higher education is

very minimal compared to another directorate. The inadequate budgeting and its effect on reliable network infrastructure is among of the problem (UNESCO, 1999; Tusubira and Mulira 2004; and Swarts and Wachira, 2010). thus leaving a gap for institutions of higher learning where this study intend to close the gap by review the nature of network infrastructures development objectives,checking status of network infrastructure development, examining manners in which plans on ICT infrastructures are carried out and assessing ICT enhancement of information flow networks.

2.8 Conceptual Framework

The conceptual framework in Figure 2.1 provides the relationships that exist between independent variables, intervening variables, and dependent variable.

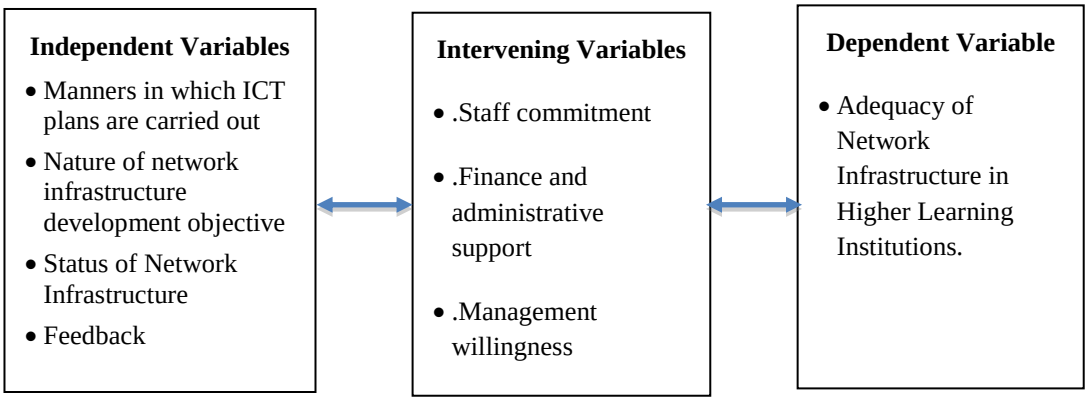

Figure 2.1: Conceptual Framework on Network Infrastructure Planning

Source: Researcher's construct, (2013)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the description of data collection, the various sources of data, and the types of data collected. A description of where the research is undertaken and people involved in the study as well as the techniques that employed in data analysis. It explains the sampling measures and states the main instruments was used in data collection from the field.

In short the chapter describes how well the study was carried out, the description includes the research design, area of the study, study population, sample size, sampling techniques, sources of data, methods of data collection, research approaches, and lastly data analysis techniques which includes methods for data interpretation.

3.2 Study Area

The study was conducted at the University of Dodoma (UDOM) in Tanzania. The study area was selected because UDOM it is among the largest university in Africa established when the ICT are in use as a tool to coordinate education activities but its network infrastructure is not reliable (Matogoro, 2011).

3.3 Research Design

Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design (Kothari, 2004). Saunders *et*

al. (2009) explain that the system can be studied with one of three types of case studies, depending on the purpose: descriptive case studies, exploratory case studies and explanatory case studies. This study adopted Exploratory case study research approach. The exploratory design is flexible and enables the researcher on discovery of ideas and insight.

3.4 Sample Size and Sampling Procedures

3.4.1 Study Population

The total population of the study at UDOM community comprised 19,671 students and 1,361 staff (UDOM 8 years, 2015).

3.4.2 Sample Size and Sampling Procedures

A study population is a group of individuals, objects or items from which samples are taken for measurement. It refers to entire group of persons or elements that have at least one thing in common. Population also refers to the larger groups from which the sample is taken (Kombo and Tromp, 2006). For that matter, the population of this study consisted of IT personnel, students and Planning Officer.

3.4.3 Sample Size

Sample is a segment of population in which researcher is interested in gaining information and drawing conclusions (Babbie, 2008). While selecting the sample size, researchers are advised to put into consideration three important aspects namely the availability of population, methods of sampling to be used and financial resources available for facilitation of the specific study (Charles, 2005). In this study, a researcher collected data from 183 respondents.

Table 3.1: Respondents Category

Respondents Category	Number of Respondent
IT personel	17
Planning Officer	10
Students	156
Total	**183**

Source: Field Data, (2016)

3.4.4 Sampling Procedures

The sampling frame was available from the University of Dodoma included IT personel, Planning officers and Students. For this case simple random selection was take place in order to obtain a good representative samples of students and Purposive sampling was used in selecting the planners and ICT officials at UDOM that were included in this study. The researcher asked all the mentioned planners and ICT officials to participate in the study for the purpose of giving more insight to the study. The researcher obtained the information that was not being available to students. And a researcher had chosen this purposive sampling technique because a researcher was sure that the participants were easily reached since was the area which the researcher was working.

3.5 Data Collection Methods

3.5.1 Types and Sources of Data

This study was collect data from both primary and secondary sources. The primary data are data obtained by the researcher efforts directly from first hand experience by means of surveys, observation or experimentation. There are some weaknesses caused by secondary sources such as outdatedness and inadequacy in terms of

coverage, the study will go beyond secondary sources and interact with the environment through interviews, observation and questionnaires (Ritchie and Lewis, 2003). On the other hand, secondary data were collected through review of documentary sources such as magazine, books, journals, articles, reports, internet, files and all relevant materials from the respective offices both published and unpublished.

3.5.2 Data Collection Instruments

3.5.2.1 Interview

Data was collected by the Interview where both closed ended and open ended questions was utilized for data collection. Interview conducted to see reporting relationship (feedback mechanism) in ICT directorate at UDOM.

3.5.2.2 Questionnaires

Gathering data through validated, appropriate questionnaires can provide robust data and insight (Fraser, 1998). The questionnaires includes IT personnel,planners and students to saw the status of network infrastructure implemented at UDOM.

3.5.2.3 Documentary Review

A Documentary review used to view and analyse the existing documents that would show evidence on strategic planning in ICT and nature of network infrastructure development objectives at UDOM.

3.6 Data Analysis Methods

Data analysis is a computation of certain measures along with searching for patterns of relationships that exist among data group (Kothari, 2004). Data analysis is

conducted with the purpose of summarising the collected data and organizing them in a way that the answer related research questions.

Data collected was analyzed by using both Quantitative and Qualitative methods. The Qualitative interpretation of results was carried out through the use of bar chart and tables. While the quantitative analysis used Statistical Analysis of both perceptual and factual data was made with the help of computer software of Statistical Package for Social Sciences (SPSS).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the findings and discussion of the data collected during field work in line with the objectives of the study. It starts by giving background characteristics of the study population. Key findings of the study are discussed in chronological order in line with the research questions.

4.2 Nature of Network Infrastructure Development Objectives at UDOM

The study intended to find out the network infrastructure development objectives. According to reviewed ICT policy document, the following are the stated objectives of the network infrastructure planning at UDOM:

(i) To provide quality services and support to the university community.

(ii) To facilitate communication externally and within the university community.

(iii) To establish a quality work environment to enhance employee efforts to support the university community.

As it observed the supply of resources, support from the management, skills of the project team and the infrastructure maintenance are the main factors that reflect the failure of the ICT infrastructure development at UDOM. Furthermore, through interview, IT personnel were asked if the stated objectives were met. Out of the IT personnel interviewed, results indicate that 12% confirmed that the stated objective was met while 88% disagreed. This shows that the stated network infrastructure

development objectives were not met because the ICT infrastructures are given low priority, which results in poor quality of network services. Similarly, Bii and Gichoya (2006) study at MOI University in Kenya found that the causes of failure ICT objectives to includes lack of fund, lack of ICT policy, lack of training, lack of sustainability of ICT resources supply and shortage of electric power supply.

4.3 Status of Network Infrastructure Implemented at UDOM

Respondents were asked to indicate the status of network infrastructure at UDOM, which aimed to understand the common type of technology which is widely used for communication and exchange of information at UDOM. The results in Table 4.1 show that 28.4% of the respondents use telephone and 71.6% use computer. Discussion with the university management indicated that the computers (Desktop) are supplied by the university and they are connected to network while the laptops are individual owned while the telephones are supplied free to the University staff by Vodacom Tanzania to UDOM. The low telephone based network use come due to the fact that the kind of handsets given staff are not compatible to accommodate internet networking.

Table 4.1: Forms of Technology used for Communication and Exchange of Information at UDOM

Form of Technology (N=183)	Frequency	Percent (%)
Telephone	52	28.4
Computer	131	71.6
Total	**183**	**100.0**

Source: Field Data, (2013)

Table 4.1 shows that 71.6% out of the total respondents prefer using computer as communication technology through staff mail while, 28.4% out of the total respondents prefer using telephone technology for communication at UDOM. For the current situation, only central administration block use telephone for inter – office communication, and this phone are IP networked phone, for Colleges this telephone system are not yet implemented though plan is still on the way as documented by UDOM Rolling Strategic Plan 2012. This implies that computer technology is used by majority at the University.

These results are similar to Chinwe (2010) findings in Nigeria University where found that in order to improve ICT services; there is a need to show how students and faculty/staff are using the internet in the academic environment. This is because the information and communication technology have given rise to new modes of organizing the educational environment in schools and new concepts in the teaching processes as well as the remodelling of the role played in the educational process.

On the other hand, more than half of the respondents (92) indicated to use Academic Registration Information System (ARIS) and (91) of them were using Students Records (SR) software systems. Both ARIS and SR used in similar function of keeping students records. These systems automate the process of registering students and keep all academic records of students from the enrolment to graduation. The systems provide academic transcripts and provisional results, accommodation process, and allow students to access lecture notes online. These two systems are accessed university wide from management, instructors and students, and every user of the system has specific role. The only different is that ARIS is program, which

purchased from the University of Dar es Salaam while SR is a program, which developed within the university by UDOM IT Expert.

Therefore, all this software systems have significantly importance to the expansion of higher learning institution and the efficiency of network infrastructure development of the University especially UDOM. Also, it was explained that, ICT, if appropriately used can assist in addressing the key educational challenges, e.g. e-learning and m-learning technologies and alternative delivery systems for access; rich and interactive digital content to improve quality; assistive technologies to contribute to equity; and the inclusion of ICT skills in the curriculum and the use of ICT to support 21st century learning can increase relevance.

Views of staff and students in the College of Informatics and Virtual Education on the use of network system in improving access to teaching and learning materials are given in Figure 4.1. The results show that the university had improved access to teaching and learning materials. This argument made in comparisons with the progress of the University since its establishment, that the University of Dodoma now is improved as compared to year 2007 of its establishment.

In Figure 4.1, 60% out of all respondents said teaching and learning material is good while 40% out of all said network system for teaching and learning is bad. By having ICT teaching infrastructures such as overhead projectors and public addressing systems have moderately show improvement on teaching. College system administrators informed the researcher that at the College of Informatics with 22 classes are well equipped with public addressing system and overhead projectors

while other five colleges each department have two projectors and they have kept to the Head of department and if the head of department she/he is not around it become the problem. The university should implement overhead projectors to all colleges to overcome the problem of keeping the projector to the head of department.

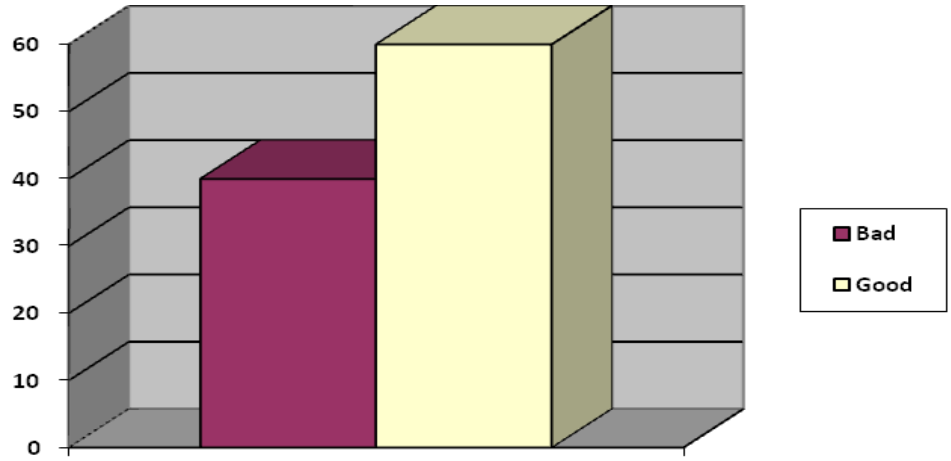

Figure 4.1: Views on the Improvement of Teaching and Learning Materials by Network System at UDOM

Source: Field Data, (2013)

Therefore, UDOM needs more effort like financial budget in order to ratify the situation or condition to improve more and have power to provide services and accommodate many users within and outside the University environment. Similar to Shyamal (2006) ICT infrastructures play a big role in academic, since the teachers will change from knowledge transmitter to, knowledge navigator and sometimes as co-learner. The new roles of the teachers demands a new way of thinking and understanding of a new way of vision of learning process.

The reasons for the poor condition of network infrastructure as given by respondents are shown in Table 4.2. The leading factors for poor network infrastructure identified

by the respondents are shortage of hardware and slowness of speed. These problems are compounded by limitation of budget.

Table 4.2: Challenges Facing Network System at UDOM

Type of challenge (N=183)	Frequency	Percent (%)
Slowness of Speed	54	29.5
Shortage of hardware	66	36.1
Back up for power system	26	14.2
Limitation of budget	37	20.2
Total	**183**	**100.0**

Source: Field Data, (2013)

The shortage of hardware and speed is attributed by massive expansion of university as reported by 36.1% and 29.5% respondents, respectively. The results (Table 4.3) indicate that out of all respondents, 36.1% need to increase budget on ICT and to be independent entity and 63.9% of the respondents need higher network bandwidth and installation of power backups. If this will do effectively and efficiently the challenge facing network systems will be minimized.

Table 4.3: Suggested Solution to Deal with the ICT Challenges at UDOM

Solution to Deal with the ICT Challenges (N=183)	Frequency	Percent (%)
Increase budget on ICT	66	36.1
Needed higher network bandwidth and installation of power backups.	117	63.9
Total	**183**	**100.0**

Source: Field Data, (2013)

4.4 Mechanisms in which Plans on ICT are Carried out at UDOM

The University of Dodoma ICT plans aimed to expand the network infrastructure to cover the whole areas of colleges in UDOM. Table 4.4 shows that, out of the all responded planner, 20 % indicates that planning of network infrastructure based on availability of ICT facilities, 30 % based on technical support and 50% showed budget received from the government. The findings indicate that the major planning criteria used for ICT is budget received from the government.

Table 4.4: Manner in which Network Infrastructure is Carried Out

Criteria used	Frequencies	Percentage
Availability of ICT facilities	2	20
Technical Support	3	30
Budget	5	50

Source: Field Data, (2013)

Though the major planning used for ICT is budget received from the government but the fund allocated each financial year is not reasonable. Actually the ICT infrastructure development at UDOM depend full on Government. As shown in Appendix 4, for each financial year, the department allocated half of what has been requested or suggested which cause the department to have unsatisfactory budget. (UDOM planning directorate, 2015). In contrary, with the university of Ghana which do not depend full on fund from the government (Omollo, 2011) in implementation of connection of fibre optic. In order to improve ICT infrastructure within the university, the university got a fund from Vodafone.

4.5 The ICT and Enhancement of Information Flow Networks at UDOM

The results Figure 4.2 show that majority of the respondents (71.6%) use telephone as a means of communication. The internet and telephones are more preferred form of ICT in use at UDOM. However, only 28.4% of the respondents use internet to make communication within and outside of the UDOM community. According to discussions with the respondents, internet is used for research whereas telephones are used for consultations. The dominance of telephone in staff communication at UDOM come due to the fact that staffs have free air time to communicate with other staff using free handsets provided by Vodacom Tanzania to UDOM also it was observed that ARIS enhance communication between students and lecturers where by lecturer post the examinations results and students views their results.

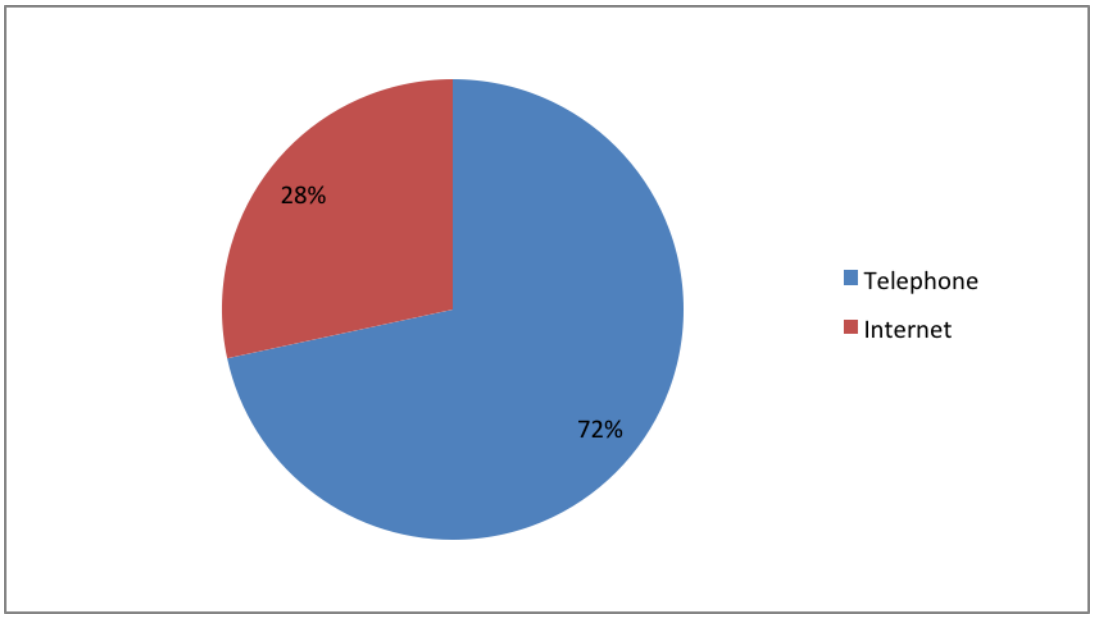

Figure 4.2: Communication at UDOM

In addition, out of six colleges, four colleges have network connectivity, which allows both internal and external mail systems, the remaining two colleges they are on process to have network connectivity. However, discussions with IT staff

indicated that the official UDOM mail systems work for IT staff. In that case, majority of staff do not have access to official mail systems. Hence, failure to get up date on various university's issues in time.

However, as given in Table 4.5, 48.6% of the respondents indicated that the flow of information is not effective and efficient at the University of Dodoma. The limited information flow led to ineffective delivery of the core function of university that depend on ICT such as teaching.

Table 4.5: Effective and Efficient Information for Delivery Core Function of the University

Effective and efficient information for delivery core function of the University	Frequencies	Percentage
Not good	89	48.6
Good	40	21.9
It is some extent	54	29.5
Total	**183**	**100.0**

Source: Field Data, (2013)

The situation at UDOM is similar to Uganda Martyrs University, the delivery of core function that is education is not good due to availability of improper ICT infrastructure into teaching and learning environments. In both institutions, most of the teachers do not have the opportunity to use technological tools such as (video players and projectors) due to the shortage of the technological tools available (Surry and Ely, 2001 cited by Twinomujuni, 2011).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Overview

This chapter provides Summary of the Major findings of the Study, conclusion, recommendations and Recommendations for Further Study.

5.2 Summary of the Major Findings of the Study

This section contains the summary of major findings of the study. The first objective reviewed the nature of network infrastructures development objectives at UDOM. The study found that the implementation plan for ICT infrastructure improvements at University is still in progress, achieving all objectives at 100 percent was a challenge. But, at phase one implementations, overall observation indicates that there is an improvement on ICT infrastructure as of internal communication and externally, though quality of services and quality working environment are not met at its totality.

The second objective determined the status of network infrastructure development implemented at UDOM. The study found that status of network infrastructure is not satisfactory to meet user expectations on the services, starting from the devices and equipment's, used, most are outdated compared to advancement in technology. This is much caused by the dependability of government funds, any advancement in technology and improvements of infrastructure runs parallel with cost implications. So the university should look an alternative source of fund in order to make the

replacement of the outdated devices rather than depending only on government source.

The third objective examined manners in which plans on ICT infrastructures are carried out at UDOM. The study also found manners in which plans in ICT are carried out at UDOM. Out of the all planners responded 20 % indicates that planning of network infrastructure based on availability of ICT facilities, 30 % based on technical support and 50% shows the budget received from the government. Findings indicate that the major planning criteria used depend on budget received from the government. This implies that lack of enough budget results in poor improvements of ICT quality service delivery. The university has to find alternative sources of fund to generate its own income.

The fourth objective assessed how ICT enhance information flow networks at UDOM. This study observe that, the use of ICT improves the inter-college communication through internal mail systems and external mail systems, also apart from six colleges available, all four colleges has connectivity, this shows that improvements have been made and whenever there is intercommunication between two entities implies there is flow of information between the two.

5.3 Conclusion

This section contains the conclusion based on the findings from the study. Conclusions are organized by specific objectives and are supported by qualitative and quantitative data where appropriate.

The study concludes that the computers (Desktop) are supplied by the university and they are connected to network while the laptops are individual owned while the telephones are supplied free to the University staff by Vodacom Tanzania to UDOM. The low telephone based network use come due to the fact that the kind of handsets given staff are not compatible to accommodate internet networking.

The University of Dodoma ICT plans aimed to expand the network infrastructure to cover the whole areas of colleges in UDOM. Findings show that UDOM is planning to improve network infrastructure based on availability of ICT facilities, technical support and increased budget from the government.

The study concluded that the use telephone as a means of communication. The internet and telephones are more preferred form of ICT in use at UDOM. However, some there is a use internet to make communication within and outside of the UDOM community. According to discussion with the respondents, internet is used for research whereas telephones are used for consultations. The dominance of telephone in staff communication at UDOM come due to the fact that staff have free air time to communicate with other staff using free handsets provided by Vodacom Tanzania to UDOM.

5.4 Recommendations

Basing on the results of this study, the following suggestions are offered to have a good network infrastructure while the expansion of university continual to take place at UDOM:

(i) The study recommend to UDOM management, network infrastructure must be re-designed to meet their high performance network goals with new levels of security, availability, performance, and operational simplicity

(ii) The study recommends to UDOM management to comply with institutional strategic plan in development of ICT infrastructures.

(iii) The study recommend to University to be innovative by establishing the internal and external sources of fund to maintain the running required costs rather than depending full from the government.

(iv) The study reccomend to complete the network connection to the remaining colleges in order to enhance information flow to the whole university.

5.5 Recommendations for Further Study

The study covered only one university in Dodoma region. In this study, the study was conducted in a local level. Therefore, there is a need to conduct a research at the national level to find out more issues related to the impact of higher learning institutions expansion on the adequacy of network infrastructure.

REFERENCES

Bii, S., and Gichoya, T. (2006). Challenges of establishing and managing an IRM centre in a Kenyan public university: A critical review of papers by MOI university IRM centre staff. Nairobi, Kenya.

Brennan, J. and Williams, R. (2004). *Collecting and using student feedback: A guide to good practice*. New York: Learning and Teaching Support Network.

Brocade communications system. (2009). Taking control of IP network Infrastructure Managmnt Software, The New York Time and other leading provides. New York, USA.

Cambridge, M. A. (2011). Feedback Mechanisms in International assistance organizations. Retrieved on 17th June 2014. from [http://www.cdacollaborative.borg/media/48015/Feedback-Mechanisms-In-International-Assistance-Organizations.pdf.].

Carnoy, M., Loyolka, P., and Froumin, I. (2013). University Expansion in the BRIC countries and the global information technology, Retrieved on 14th June 2014 [http://fsi.stanford.edu/sites/default/files/University_Expansion_in_the_BRIC_Countries.pdf].

Cgnet, M. (2009). Situation Analysis of ICT Capability and Infrastructure in RUFORUM university Final Report. Stockholm, Sweden.

Commscope, (2011). Network Infrastructure Solutions for Education. Retrieved on 10th June 2014. from [http://www.commscope.com/docs/education_brochure.pdf].

Coutinho, N., Zenner, J., and Donahue, C.(2011). Network Infrastructure: Building a more Efficient network with greater capabilities,capacity and security, Retrieved on 15th September 2014. [http://www.fedtechmagazine.com/sites/default/files/rg_nw_optim_042011.pdf],

Duncan, N.B. (1995). The Invisible Weapon: A Study of Information Technology Infrastructure as a Strategic Resource. Dissertation, Texas A & M University. Texas, USA.

Earl, M. J. (1989). *Management Strategies for Information Technology*. London: Prentice-Hall.

European University Institute.(2014). About the ICT Service. Retrieved on 13th July 2014. from [http://www.eui.eu/ServicesAndAdmin/ComputingService/About/Index.aspx].

Farrell, G., and Shafika, I. (2007). Survey of ICT and education in Africa: A summary report based on 53 country surveys. Washington, DC: Retrieve on 16th october 2014 info/Dev/World Bank. [http://www. infodev.org/org/en/publication.353.html].

Ferris, S. (2011). Information and communication technology, Catholic Relief Services, meeting was held at USAID. New York, USA.

Fraser, B. J. (1998). Classroom Environment Instruments: Development, Validity and Application. Learning Environments Research 1, 7–33, Kluwer Academic, Retrieve on 4th July 2014. [http://www.geocities.ws/elli_bar_ilan/fraser.pdf.],

Gay, G., and Lentini, M. (2006). Use of Communication Resources in a Networked Collaborative Design Environment, *Journal of Computer-Mediated Communication, 1(1)*. 23 – 41.

Glen, D. (2009). Determining sample size, Gainesville, FL: Florida State University, Retrieved on 11th Augost 2014. [http://edis.ifas.ufl.edu/pd006].

Grobler, G. (2013). UNISA on the challenges facing higher education, Retrieved on 6th July, 2014 [https://beyond2015.acu.ac.uk/submissions/view?id=50].

Holt, M. (2009). Effective communication methods in an organization. In Chron Small Business, Retrieved on 7th June 2014. From: [http://smallbusiness. chron.com/effective-communication-methods organization-2.html].

IBM Corporation, (2007). IBM Networking Strategy and Optimization Services-Network Infrastructure Optimization: Improving Network Performance while controlling cost. Retrieved on 13th June 2014. from: [http://www-07.ibm.com/ events/my/btf/download/Network_Strategy.pdf.],

Kothari, C. R. (2004). *Research Methodology:Methods & Techniques. (2nd edition).* New Delhi: New Age International(P) Limited

Laudon, K. C., and Laudon, J. P. (2001). *Essentials of Management Information Systems*. (Ed) New Jersey: Prentice Hall.

Mathieson, K. (1991) "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior", *Information Systems Research (2)3,* 173–191.

Matogoro, J. (2011). Design and Implementation of network monitoring system using open source software a case of university of Dodoma Network, Masters Dissertation report, The university of Dodoma, Tanzania.

McKay, D. T., and Brockway, D. W. (1989). "Building I/T infrastructure for the 1990s". *Stage by Stage. Nolan Norton and Company, 9(3),* 1-11.

McLaughlin, J., and Skinner, D. (2000). "Developing Usability and Utility: A

Comparative Study of the User of New IT", *Technology Analysis & Strategic Management (12) 3,* 413–423.

Ministry of information and Communications, (2006), National Information and Communication Technology (ICT) Strategy for Education andTraining Republic of Kenya. Retrieved on 14th May 2014. From: [http://www.ist-africa.org/ home/files/Kenya_ICTPolicy_2006.pdf].

MoEVT, (2007). Infomation and communication technology policy for basic education, Retrieve on 3rd July 2014. from: [http://www.tanzania.go.tz/egov_uploads/documents/ICT_Policy_for_Basic_Education_sw.pdf].

Ngailo, L. N. (2012). Project planning and management: A logical framework Approach, Second edition, Moshi Tanzania.

NICI .(2015). National ICT strategy and Plan, Retrieved on 14th May 2014. From: [http://www.rdb.rw/uploads/tx_sbdownloader/NICI_III.pdf].

Richards, L. (1980). How effective communiaction will help an organization, Retrieved on 8th July 2014 from: [http://smallbusiness.chron.com/effective-communication-organization-1400.html].

Robbins, S., Coulter, M., and Kotze, R. (2003). *Foundations of Planning*, New Jersey: Prentice-Hall.

SAITIS, (2005). *South African ICT Sector Development Framework*. Available on the Internet: http: Retrieved on 17th February, 2016. From: www.dti.gov. za/saitis/docs/ictnov-00-summ.html.

Saunders, M. N. K L., and Thornhill, A. (2009). *Research Methods for Business Students. fifth edition*. Harlow: Prentice Hall-Financial Times

Swarts. P., and Wachira, E. M. (2010). Tanzania: ICT in education Situational Analysis, Global e-schools and Community Initiative. Retrieved on 10th October 2009. from: [http://creativecommons.org/licences/by-nc-sa/3.0/].

Tabu, D. (2014). Network security Enhnacement through Honeypot a case of University of Dodoma: Masters dissertation report, University of Dodoma. Tanzania.

Tanzania ICT Policy, (2003). National Information and Communication Technologies Policy Retrieved on 8th august, 2014 from: [www.tanzania.go. tz/pdf/ictpolicy.pdf].

The Frame Group Pty Limited, (2013). ICT strategic planning, Retrieved on 22nd August 2014 from: [http://www. framegroup.com.au/ict-strategic-planning/],

Tusubira, H., and Mulira, S. (2004). Integration of ICT in Organizations: Challenges and best practice recommendations based on the experience of Makerere University and other organizations, Retrieved on 23rd August, 2014 from: [http://www.fftusubira.com/publications/Integration_of_ict.pdf].

Twinomujuni, J. A. (2011). Problems in ICT implementation in selected institutions of higher learning in Kabale District in Uganda. Kabale Uganda.

UDOM 8 years, (2015). Reflections and projections Page 14. University of Dodoma, Tanzania.

UDOM Rolling Strategic Plan. (2012). Level of student Enrolment at University of Dodoma, Tanzania.

Ujunju, M., Wanyembi, G., and Wabwoba, F. (2012). Evaluating the role of Information and communication Technology (ICT) support towards processes

of management in institutions of higher education: *International Journal of Advance computer Science and Applications. 3(7)*, 34 – 51..

UNESCO and the Academy for Education Development, (2002). *Technologies for education: Potentials parameters and prospects*, Washington, DC: UNESCO.

UNESCO, (1999). *A survey on the use of computers, e-mail and the Internet in education, culture and communication:* Electronic Connectedness in Pacific Islands Countries, UNESCO.

UNESCO, (2009). ICT for higher education, Retrieved on 4th July, 2014 from: [unesdoc.unesco.org/images/0018/001832/183207e.pdf].

Warner and Havens.(1966). Displacement and the intangibility of Organizational goals. Retrieved on 14th June, 2014 from: [http://www.joe.org/joe/1967 spring/1967-1-a5.pdf].

Wilfrid laurier University: (2014). Service desks - Information Technologies Services, Retrieved on 22nd October, 2014 from: [http://www.wlu.ca/home page.php?grp_id=61].

World Bank, (2013). *ICT Glossary Guide. 100 ICT Concepts.* Washington DC: World Bank.

APPENDICES

Appendix 1: A Questionnaire to be administered to Students at UDOM

SECTION A : BACKGROUND INFORMATION

1. Education of respondents

(i) Primary (ii) Secondary (iii) College (iv) University (v) Non-formal education

2.Age of respondents

(i) 18-36 (ii) 37-55 (iii) 56-74 (iv) 75+

3. which course/program are you taking? (please, name)

(i).....

(ii).....

(iii).....

4.Do you know the nature of network infrastructure development objectives at UDOM?

(a) Yes

(b) No

5.How does the expansion of your University affects the network system at your University?

(i).....

(ii).....

(iii).....

6. What are the challenges facing network systems at your college

(i) Speed

(ii) Shortage of hardware

(iii) Back up for power system

(iv) Any

(v) other,

7. What needs to be done to deal with these challenges?

(i).....

(ii).....

(iii).....

8.What forms of technology are used for communication and exchange of information in your University

(i) radio

(ii) television

(iii) telephone

(iv) compueter

(v) Any other, please, list

9.May you explain on the software system in place at your University?

(i).....

(ii).....

(iii).....

10.How does network system at your University have improved access to teaching and learning materials?.....

11.How do you value the status of network infrastructure for this University

(i) Bad (ii) Moderate condition (iii) Good condition (iv) Excellent

12. What are sytems/strategies in place to maintain the good/excellent condition (please, list)

(i).....

(ii).....

(iii).....

13.What are the initiatives in place to improve the poor/bad condition of your network infrastructues

(i).....

(ii).....

(iii).....

14.How is the information flow carried out at UDOM

.....
.....
.....

15.Does this flow effective and efficient for delivery of core functions of the University?.....
.....
.....
.....

Appendix 2: Interview Guide for it Personnel and Planning Officer

1. What were the objectives and goals of UDOM Network Infrastructure in your organization?
2. What approaches did you use to implement Network Infrastructure in your organization (i.e. installation, customization, testing etc.)
3. Explain the status of Network Infrastructure in your organization.
4. Explain the service quality of Network infrastructure in your organization (training and support)
5. What objectives or goals of network infrastructure have been achieved so far?
6. Can you please tell me how is this managerial system structured in your level?
7. Do you have any recommendations on the implementation of LGHRIS?

Appendix 3: ICT infrastructure Budget at UDOM

SEGMENT 4 (GFS CODE)	Segment 4 Description (GFS Code Description)	Forward Budget Estimates 2012/13	Forward Budget Estimates 2013/14	Forward Budget Estimates 2014/15	Forward Budget Estimate 2015/16
1	2	3	4	5	6
F01S02	**To Strengthen Effective Communication System**				
22212	Harmonize communication at UDOM	209,000,000	261,250,000	326,562,500	408,203,125
22212	Institute UDOM ICT centre to manage and develop ICT services at UDOM	210,000,000	262,500,000	328,125,000	410,156,250
22212	Improve Communication Facilities	280,000,000	350,000,000	437,500,000	546,875,000
22212	Provide University Almanac on the UDOM website	4,000,000	5,000,000	6,250,000	7,812,500
22212	Provide website and Internet service	40,000,000	50,000,000	62,500,000	78,125,000
22212	Update colleges and schools website and link to the UDOM website	15,000,000	18,750,000	23,437,500	29,296,875
22105	Introduce Centre for research, development and innovation in ICT	100,000,000	125,000,000	156,250,000	195,312,500

22231	Training of technical and administrative staff	12,000,000	15,000,000	18,750,000	23,437,500
SUB TOTAL		**870,000,000**	**1,087,500,000**	**1,359,375,000**	**1,699,218,750**
G01S01		**To Provide Efficient and Timely Administrative Services**			
21144	Office refreshments	10,000,000	12,500,000	15,625,000	19,531,250
21242	Repair & maintenance-computers hardware & infrastructure	190,000,000	237,500,000	296,875,000	371,093,750
21204	Capacity building and Enhance ICT capacity at UDOM	30,000,000	37,500,000	46,875,000	58,593,750
21206	Workshop and seminars	20,000,000	25,000,000	31,250,000	39,062,500
21224	Provide printing &stationary & other office consumables	20,000,000	25,000,000	31,250,000	39,062,500
21244	Support services-application software	28,000,000	35,000,000	43,750,000	54,687,500
21206	Workshop and Seminar	2,000,000	2,500,000	3,125,000	3,906,250
21212	Provide website and internet	20,000,000	25,000,000	31,250,000	39,062,500
SUB TOTAL		**320,000,000**	**400,000,000**	**500,000,000**	**625,000,000**
GRAND TOTAL		**1,190,000,000**	**1,487,500,000**	**1,859,375,000**	**2,324,218,750**