USE OF GEOSPATIAL ANALYSIS TO SUPPORT RESOURCE ALLOCATION DECISION-MAKING IN HEALTHCARE PROJECTS A CASE OF USAID HIV/AIDS IMPLEMENTING PARTNERS

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By

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A Dissertation Submitted in (partial) Fulfillment of the Requirement for the Degree of Master of Public Health of

Muhimbili University of Health and Allied Sciences
October, 2017

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***"Use of Geospatial Analysis to Support Resource Allocation Decision-Making in Healthcare Projects: A Case of USAID HIV/AIDS Implementing Partners"***, in (partial) fulfillment of the requirements for the degree of Master of Public Health of Muhimbili University of Health and Allied Sciences.

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Dr. Amani Anaeli

(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, **Yohana Wilfred Mapala** declare that this **dissertation** is my own original work and that it has never been presented and will not be presented to any other university for a similar or any other degree award.

Signature…… **Date**…….

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Finally, I take a full responsibility for any faults that would be found in the design, analysis, and interpretation of the information collected during the study.

DEDICATION

I dedicate this work to my wife Lilian Mkubulo and my children Talitha and Mapala.

ABSTRACT

Background: Geospatial analysis identified as one of the best tools for improving decision making in donor financed healthcare projects that involve partnership with local organizations. However, for Tanzania, geospatial technology remains rare skill. The USAID and other DPs introduced GIS techniques as a way of supporting cost effectiveness allocation of resources for HIV/AIDS treatment. Planners and decision makers from different USAID HIV/AIDS implementing partners identified and trained in GIS. However, the status of adoption and use of geospatial techniques remains paradoxically unclear.

Objectives: The study aimed at examining how planners and decision makers from implementing partner organizations consider geospatial methods useful in improving resources allocation planning and decision-making. The study explored initiatives of the implementing partners to support adoption, how the users consider GIS techniques to be useful, and the challenges that experienced in the adoption and implementation.

Methods: This study employed a cross sectional descriptive design. It involved 30 training of geospatial champions from 15 organizations under the USAID HIV/AIDS programs in Dar es Salaam. Twenty eight of the respondents who were still employed in the programs were interviewed and 14 of them participated in two Focus Group Discussions (FGDs). Data analysis involved qualitative content analysis, which was based on both the literature and new emerging themes from the interviews and FGDs.

Results: Study results revealed that majority of the respondents had not successfully adopted the use of geospatial techniques in the day-to-day job activities. Most of the respondents felt that GIS was appropriate since its use made them perform professionally and could justify their resources allocation decisions. However, they found GIS to be difficult due to lack of access to software, limited skills that GIS needed including computer and ICT skills, limited support from the organizations, high cost of GIS software, and some notable inconsistences within the development of the GIS technology itself. While respondents thought GIS was useful in their job, many of them failed to sustain its use due to several challenges. The main challenges were lack of close support from the

organizations, higher cost of the GIS software, limited availability of the software and hardware in the organizations, and limited skills in GIS, computer, and ICT.

Discussion: The findings consistently revealed the importance of organizational support, which employees required to make successful adoption and use of GIS. The findings show that in organizations, which provide close support and encourage employees to use the GIS technology there are more chances for successful adoption compared to those, which do not.

Conclusion: The study concluded that organizational support is very important in the adoption of useful technologies such as GIS. Even in situations where employees find a new technology useful, limited material and psychological support remains crucial.

Recommendations: The study recommended that the USAID should make the use of GIS compulsory for implementing partner organizations and provide continued support in terms of training, software, and hardware. The management of the implementing partner organizations should incorporate GIS skills as a measure of individual performance and use the available GIS champions to train the rest of the employees.

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LIST OFABBREVIATIONS

ART	Antiretroviral Therapy
DACC	District AIDS Control Coordinator
DCDO	District Community Development Officer
DMO	District Medical officer
GIS	Geographic information system
GIT	Geographical Information Technology
HIS	Hydrologic information System
HIV/AIDS	Humman Immne Virus/Acquired Immnune Defficiency Syndrome
ICT	Information Communication Technology
M&E	Monitoring And Evaluation
MoH	Ministry of Health
PMTCT	Prevention of Mother to Child Transmission
USAID	United States Agency for International Development
VCT	Voluntary Counseling and Treatment

CHAPTER ONE

1.0 INTRODUCTION

1.1. Background

The use of maps is a relatively new invention in healthcare research, but history shows that maps have been in use for more than a century ago, especially in epidemiological studies (Maliene, Grigonis, Palevicius, & Griffiths, 2011). The presently increasing use of Geographical Information Systems (GIS) is attributed to the development of mapping method for representing information on the earth's surface, which dates back to the early 19th century (Ogrosky, 2003). In 1840, Robert Cowan used maps to show evidences of disease spreadness in relation to population (Mesgari & Masoomi, 2008). Historically, this marked the use of maps in health related research, especially diseases related research.

There are evidence to show that the use of map in health conditions is an old invention. For example, evidence show that maps were used to show relationship between crowding and incidences of yellow fever in Glasgow in England (Crampton, 2011). In addition, in 1843, he used a map to show households that affected by Typhus epidemic. In 1843, Robert Perry used geospatial methods to show and describe difference in the prevalence of fever in different neighborhoods (Milson & Alibrandi, 2008). In 1845, John Snow used epidemic mapping methods to locate the wells, which had been contaminated and thus responsible for cholera deaths in London.

Since its discovery in the 19th century, the use of geospatial analysis has expanded across different fields and knowledge areas. Some few areas in which geospatial analysis is used include studying topography for settlement and land use planning, budgeting and resources allocation, military activities, studying and allocating diseases and their causes.

Scholars argue that geospatial analysis originally used in environment and life related scientific endeavors. In environment related fields, geospatial analysis was common in geology and ecology. In settlement planning and development, it is used to plan path routes and set location for different services, especially services that need to be allocated in relation

to population, settlement patterns, and other topographical factors (Milson & Alibrandi, 2008). In business fields, geospatial analysis is potentially crucial in identifying and classifying as well as locating customers, their needs, market characteristics and trends, as well as consumption power of different customer groups. Thus, geospatial data serve crucial purposes in marketing and business success.

In Anthropology, Coffin, Swett, and Cole (2012) show the use of spatial analysis to identify cultural patters, lifestyles, and social values and how they influence social services. In population studies, geospatial analysis is combined elevation and land use or land cover data to show population density on a map. According to Sleeter (2008), this method of depicting population is more effective compared to the traditionally used color census areas. Maps resulting from this method are identified by scholars as allowing better planning, especially when it comes to plan for redevelopment of highly developed areas.

More recently, geospatial methods used to maximize the quality and use of data collected and previously analyzed using classical scientific methods. As shown in the example of the US National Geological Survey data, survey data for six wetlands and three urban areas were converted from Best Practices vector data to Semantic Web data format. As Bulen, Carter, and Varanka (2011) observed, this conversion expanded the functionality of data and capabilities for users of the National Geological Survey map. In other words, geospatial methods are used to manipulate existing data and make them of recent need and use.

Indeed there are other identified innovative and creative forms of utilization of geospatial data as a means for generating, manipulating, and reorganizing human activities and environmental data to make them useful in the process of development planning (Milson & Alibrandi, 2008; Moise & Kalipeni, 2012). The advantage attached to geospatial data is the simplicity in visualization, meaning creation, and easy understanding by stakeholders. For some scholars, maps and information on maps communicate easily as it is possible to show where specific interventions are more crucial (Omojola, 2014). This is especially achieved through the ability to show clear geographic and demographic characteristics of different areas, which in the long run make different communities need different forms and intensity of social economic

development interventions (Brewer, 2005). In general, maps have strong conveyance of information compared to texts or verbal information.

In the 20th century, the use of geographic methods spread across regions and across social economic field. In the US, geospatial analyses were adopted as a formal tool for budgeting and decision making since 1953. Since then, it used to determine resources allocation and development. In 1990, under the government circular, a coordinating and regulating committee including representatives from 30 federal governments was established to coordinate usage of geospatial infrastructure in development planning (Bossler, Jensen, McMaster, & Rizos, 2004). Geospatial data usage has been promoted in both private and public institutions working on transportation, community development. Geospatial techniques are also increasing in agriculture, emergency response, environmental management, and information technology to inform plans and decisions (Crampton, 2011). In addition, national institutions and systems such as the Federal Geographical Data Committee (FGDC) and the National Spatial Data Infrastructure (NSDI) putted in place since the 1990s.

Apart from support by sectors and industries, the growth of geospatial analysis in the United States was promoted by scientific investment and research by scientists such as Ian McHarg who promoted the "4Ms" idea meaning measuring, mapping, monitoring, and modeling in architect engineering. For McHarg and Mumford (1969), the nature was made up of landscape of which each fits (McHarg & Mumford, 1969, p. 110) with man differently. Equally, in the US and Canada, the name 'Roger Tomlinson' is well associated with leadership and fatherhood of geospatial analysis since the 1960s through his efforts towards building a digital natural resource inventory system for Canada. Resulting from these developments, it has been a claim of the Americans that they are developers and thus owners of the geospatial timeline, which make them consider developments of geospatial technology in the US as a substitute of its development worldwide (Trautmann & MaKinster, 2010). While scholars note some challenges in the use of geospatial data, they note success stories in the usage towards improving planning decisions and response to sector specific population problems.

The newer developments in applying geographical and map related knowledge came about during the first and second world wars. During these times, advances were due to introduction of satellite technology and the use of computers for military cartographic purposes. During the Cold War, the world saw growing competition in the use of satellite photographs and computers in mapping and locating world surface features, especially for military purposes (Armstrong, 2002). With computer and Information Communication Technology, it has been possible to develop systems that could capture, store, manipulate, analyze, manage, and present different types of spatial or geographical data as required and applied in different social, economic, and political activities (Bossler et al., 2004; Trautmann & MaKinster, 2010). The use of maps to show sophisticated information on maps more became a next level innovation, which is used in making decisions based on the use of computerized Geographical Information Systems (GIS) technologies. As part of these advances, the GIS technology is widely used in the analysis of different health related spatial data.

Since the early 1990s, the use of geospatial analysis has increasingly informed decisions and interventions, especially in developed countries. For example, research has suggested that the use of geospatial analysis has provided opportunity for locating and solving health problems in developing cities such as Bangkok (Bishop et al., 2000), Shijiazhuang, and Hebei (Xiao et al., 2006) as well as understanding land use and population expansion in Wuhan city (Cheng & Masser, 2003). In India, geospatial analysis has been used to understand patterns of infant and child mortality over two successive decades and design interventions that consider spreadness of incidences (Singh, Pathak, Chauhan, & Pan, 2011). Generally, in some parts of Asia, South America, and India, the use of geospatial data for purposes of designing health interventions has grown into a strong and institutionalized culture.

Recently, geospatial methods have become important in health care interventions outside as well as within Africa. The methods are used to make distinction and monitor presence and spreadness of diseases in different populations (Milson & Alibrandi, 2008). The emergence of health geography as a sub-field of interest in healthcare has become turning point for increased use of geospatial techniques since the early 2000s.

According to Sherman, Spencer, Preisser, Gesler, and Arcury (2005) it expanded choice for researchers to monitor diseases risk factors across populations. For Maantay and McLafferty (2011), a rich combination between geographical technology and cluster analysis of infections prevalence, especially waterborne infections increased the capacity of Cromley University Medicine Department to detect infections and thus contributed much towards improved preventive services of the department.

Geospatial techniques in public health forms an important an important scientific revolution. Unlike the classical correlational studies, it is argued that geospatial data provide simplified means of predicting diseases' risks based on environmental characteristics of a specific area (Bergquist & Rinaldi, 2010). The combined use of exploratory and spacial statistics allows health researchers to study diseases causing agents and hosts whose life cycle characteristics change according to environmental characteristics such as climate. Related to this, Mabry, Olster, Morgan, and Abrams (2008) suggest that apart from enriching health research, geospatial methods have attracted the contribution of research from multiple disciplines and thus simplified the understanding of disease conditions and their causes as attached to and determined by human environments and the social ecology.

In Africa and Tanzania in particular, geospatial technology was introduced and promoted as part of development partners' support. The emergence of donor-supported projects necessitated improved and accurate planning of resource. In case of Tanzania, experiences show that geospatial techniques have been evidently successful in urban land and resources planning. Their importance in health care promotion is of emphasis, but little evidence of success can be cited. While African countries continue to face resources' constraints, donors including the USAID attribute the use of geospatial techniques with better results in terms of rationalizing resources. This is an intervention study designed to examine the adoption and use of geospatial techniques in the USAID HIV/AIDS projects implementing partners in resources allocation planning and decision-making. The study was focus on the initiatives used to

support adoption, users experience on the usefulness, and the key challenges to in the adoption and use of geospatial methods.

1.2. Statement of the Research Problem

Effective allocation of scarce resources for healthcare requires that decision makers should capable of making decisions that are cost effective. Cost effective decisions cannot be made if decision makers lack appropriate information. Among the most important types of information are the ones that can clearly show distribution of health problems in the population. Equally, to distribute resources cost effectively, decision makers need to know the number of people who need the service. Being one of the low-income countries, which are affected by HIV/AIDS, Tanzania's health system attracts resources from donors and development partners. Geospatial analysis were taken as a recommended solution for generating information that can accurately address specific problems of specific human beings in their specific settings. Those realities have made the use of geospatial technology an inescapable development. In some of the previous studies such as Masser, Campbell, and Craglia (1996), it was evident that local authorities were mandatorily required to us GIS to improve their decisions.

Since the 1990s, USAID has been a significant supporter of HIV/AIDS treatment activities in Tanzania. Between 1990 and 2014, USAID financial commitment has significantly grown from 35,000 USD up to an obligated amount equals to 110,500,000 USD between October 2011 and June 2013 (USAID, 2014). However, of that amount, the USAID audit report of 2014 found questioned and unsupported costs of 41,234,680 (Emmet et al., 1997; USAID, 2014, p. 2). The USAID noted with concern and recommended that all implementing partners need to justify expenses of the money and make sure that those who participate in planning allocation should be well trained. While HIV prevalence has slightly dropped from 7.0 percent in 2003 to 5.1 percent in 2015 (Gouws, 2015), the need for more investment in HIV/AIDS treatment remains big.

Noting the need for improving the cost effectiveness in spending on HIV/AIDS interventions, the USAID as a leading financier recommended and supported implementing partners to start using geospatial techniques. The assumption was that the partners could be able to build rational plans and decide how to allocate resources based on the geographically identified and documented deeds. The next step was to identify and train personnel from implementing partner organizations who are engaged in the day to-day planning and making decisions related to allocation of resources, especially money on GIS.

Despite the rational intention of the donors, the USAID in particular to support the use of geospatial techniques, there are no observable evidence that geospatial techniques have been successfully adopted and effectively utilized. A limited number of studies show evidence of successful adoption and use in disease vector distribution (Dongus, Mwakalinga, Kannady, Tanner, &Killeen, 2011), costal land resources use (Wang et al., 2005), and water demand and supply (Hoffman, Melesse, & McClain, 2011) studies in Tanzania. In case of healthcare resources allocation planning and decision making, evidence on adoption and use of geospatial techniques are missing There is therefore a need to explore experiences of planning and decision making staff from the implementing partners regarding the adoption and use of geospatial techniques in the day-to-day activities related to allocation of resources. To achieve this, the study explored adoption support initiatives, experiences of users on the usefulness of the GIS techniques, and the challenges they have experienced regarding the use of geospatial techniques in their organizational settings.

1.3. Study Rationale

Adoption and use of geospatial methods is perceived as a way of improving plans and decisions for effective allocation of resources. In the context of Tanzania where resources are scarce, donor financed health interventions need to be well supported to make sure that planners and decision makers can effectively use geospatial methods. While planners and decision makers from USAID HIV/AIDS implementing partner organizations were trained on GIS, there is no evidence on whether they were able to adopt and use the skills provided to them. GIS is one of the well-promoted technologies. There are no any other studies conducted

in Tanzania to understand the context for adoption and use of geospatial methods in resource allocation decision making.

This study is timely since there is a need to explore the experiences of those employees who were trained regarding the adoption and use of geospatial techniques. Without this study, it is difficult to understand the how worth were adoption support initiatives, usefulness as perceived by users, and the challenges that the implementing partner organizations faced on the course of adopting and using geospatial techniques.

1.4. Research Questions

The study was guided by one central research question, which has been broken down into three interrelated research questions.

1.4.1. Central research question

The central question addressed by this study was: what are the experiences of the USAID HIV/AIDS projects implementing partners regarding the adoption and use of geospatial methods in improving planning and making decisions related to allocation of resources?.

14.2. Specific research questions

Based on the central question, the study addressed three interrelated research questions. These are:

i. What are the initiatives used by the implementing partners to support the adoption of geospatial analysis?
ii. What are the experiences of key decision makers regarding the usefulness of geospatial analysis techniques in making resources allocation decisions?
iii. What are the main challenges associated with the use of geospatial methods in the USAID/HIV projects implementing partner organizations?

1.5. Study Objectives

1.5.1. General objective

The general objective of the study was to explore the experiences of planners and decision makers from USAID HIV/AIDS projects implementing partners regarding the adoption and use of geospatial techniques in improving decisions related to allocation of financial resources.

1.5.2. Specific objectives

i. To examine the initiatives that implementing partners use to support the adoption of geospatial techniques.
ii. To explore the experiences of key decision makers regarding the usefulness of geospatial analysis techniques in making resources allocation decisions.
iii. To analyze the main challenges associated with the use of geospatial methods among USAID/HIV projects implementing partner organizations.

1.6. Significance of the Study

This study is significantly useful for both academic research and health care as well as health information systems practitioners.

First, being the first empirical first hand study on the adoption of geospatial technology in health projects planning and decision making, the study will offer first-hand information on the context that affect the adoption and implementation of geospatial or related technologies in Tanzania's organizations.

Second, the study has documented practical recommendations, which will help the USAID and its HIV/AIDS implementing partners select and prioritize processes to be carried out for successful adoption of geospatial and related technologies. Specifically, it enlightens that cooperative support and motivation of innovation champions from organizations and their management as well as integrating innovations into strategic management functions including performance management are the most crucial and feasible prerequisites.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1. Introduction

The literature on the use, importance, and challenges in using geospatial data, geospatial analysis, and generally GIS is growing. However, evidences of successful introduction and effective use of geospatial and other geographical approaches in health studies have revealed uneven results. This section synthesizes and discusses findings from different relevant theoretical and empirical studies focusing on different aspects.

2.2. Conceptualizing Geospatial Analysis

The terms geospatial methods, geospatial technologies, geospatial analysis, geographical approach, and GIS are used overlapping by researchers across fields. As a result, the scope of geospatial methods has been unclear and sometimes creating contradiction in the existing body of literature.

Geospatial technology broadly includes a broad array of measuring technologies for earth surface features viewing, patterning, locating, positioning, and sensing using special technological equipment (Milson & Alibrandi, 2008). It therefore include the commonly heard technologies such as the Geographical Information System (GIS), Global Positioning System (GPS), or Remote Sensing (RS) technology (Bossler et al., 2004). Despite the fact that these technologies differ in terms of equipment used, usage purpose, and logic of use, they are commonly used with a purpose of mapping or analyzing earth surface. Therefore, the combination of satellite images, ICT, and the classical map use is what is simply referred to as GIS.

In a technical language, GIS is a combination of computer digital technology, software, maps, and information on environmental and human phenomena and the capability of this combination to sort, pattern, arrange, and organize such information into simple layered sets of maps (Armstrong, 2002). The prime characteristic of GIS mapping of information is layering,

which allows the software to locate and objects or location on its accurate position on the earth's surface (geo-spacing) (Maliene et al., 2011). The other main feature of GIS is its auto scaling of layered maps in order to locate objects in their actual location and show difference in the characteristics of objects found in different locations. Scientifically, this is the essence of the term geospatial.

Despite the fact that there is no single agreed definition of geospatial analysis or spatial analysis (Dennis & Carte, 1998; Maliene et al., 2011), for the purpose of defining and limiting the scope of the study, an operationally inclusive definition is required. As put simple by Goodlitch (2015), geospatial analysis concerns 'what' and 'where', makes use of geographical information on the earths' surface, which links man an phenomena-and thus acts as an interface between man and computer. Thus, geospatial analysis as used in this study refers to collecting, organizing, display, and manipulating information (images, names, photographs, or numerical) and describing them clearly considering geographical coordinates or indirectly associating them with geographically identifiable locations such as villages, forests, roads, neighborhoods.

2.3. Use of Geospatial Techniques

From the empirical angle, the question that the study seeks to interrogate in the literature is whether the use of geospatial technology and methods contribute towards improvement of decisions, both within and out of healthcare areas. Different studies have been conducted and reached different conclusions regarding this question. This subsection reviews some of these studies.

Mesgari and Masoomi (2008) conducted a study to investigate infectious diseases in the population and their occurrence by locations. The study simultaneously combined spatial and statistical analysis. The study revealed that pneumonia had a direct relation with time and highest dependence coefficient (94 %) and its distribution in crowded areas was high. It noted that use of geospatial methods yielded sufficient analytical information on disease distribution.

Therefore, the use of visual data according to the population helped to improve different decisions related to health interventions.

Dennis and Carte (1998) conducted an experimental study to examine the efficacy of decisions improvement between studies using map presentations and tabular presentations. The study found that the decision makers using map-based decisions were successfully making faster and accurate decisions. They also used adjacency relationship with areas on the maps they were using to determine where more efforts could be directed. However, the study found that decisions based on use of maps quicker, but inaccurate on geographical activities in areas where there were no such adjacency relationships. From this study, one may that the use of geospatial methods and techniques may not guarantee accuracy. Instead, both the quality and accuracy of decisions may depend on the accuracy of maps used, data used, and the adjacency relationship between the areas shown on the maps.

Masser et al. (1996) studied the use of GIS data, which was mandatory recommended for making decisions for community health delivery in most of the local government authorities in Europe. The study found that most authorities used GIS to estimate diseases because of water pollution. Some authorities had clearly found that water pollution pattern was associated with direction of diseases. Thus, GIS allowed authorities to determined system requirements for managing and taking care of disease and factors that caused diseases. Finally, GIS was used in developing and managing system for storage and recovery of data, which informed important pollution control interventions.

2.4. Initiatives for Supporting Adoption of Geospatial Techniques

The adoption of geospatial technology and related techniques requires commitment and support from both users and organizations. Studies have pointed out different initiatives that need to be in place to support the process of adopting geospatial techniques. It means, if there are no such support initiatives, successful adoption comes at threat. Baker and Witham Bednarz (2003) in their systematic review of research on GIS education identify two important initiatives that go with adoption of geospatial technologies. The firs initiative is putting in

place an action plan for adapting people to the innovations. This is because, in their view, people adopt new thigs at different paces. There are three types' adopters, namely early adopters, late majority, and the laggards. The lesson that the study emphasizes is that, people need continuous support to make sure that all successfully adopt the use of the new technological innovation. The second is that, there is a need for commitment towards success of the adoption, which must be made part of the wider organizational strategy. This means that the adoption should be supported from the corporate level.

The Federal Geographical Data Committee, FGDC (2014) provides a comprehensive set of strategic initiatives that organizations should use in the adopting of geospatial methods. The initiatives include strategic vision, shared governance, executive support, designated coordinator or manager, use of recognized industry standards, and a geospatial implementation strategy or plan. With these, the author emphasizes that the adoption and use should not take a form of build it one and use it a bunch, instead, there should be a strong foundation that include all these strategic components. These components allow the organizations in cooperation with employees to build continuous learning and coordination, which in turn increases motivation.

Related to the current study, the investigator will pay attention to explore whether the main components, were in place during the adoption. These include a strategic vision that places geospatial techniques at the centre of success, existence of specified action plan, shared and participatory governance, coordination, and recommended and corporately recognized industry standards.

2.5. Factors for Successful Use of Geospatial Techniques

There is a limited literature on the determinants of successful geospatial adoption and implementation. Much of the existing evidences are derived from a broad literature on adoption and implementation of innovations in organization. However, based on these factors, it is possible to identify some factors, which may allow for successful adoption and use of geospatial technologies and techniques in organization.

According to Bossler et al. (2004) successful adoption of geospatial innovations in organizations requires making such innovations part of the business operations. Specifically, it depends on combining successfully the day-to-day business of the company with the geospatial innovations. A close argument is presented by Ogrosky (2003) regarding the initiation and implementation of the National Mapping program. It shows that success in the implementation of the program was due to successful integration of mapping project with new emerging technologies and international initiatives. The study cites many success stories in states, which included continuity and positive participation and support by stakeholders. For example, the United States Geologists' Survey (USGS) played an important role in supporting national wide promotion of standards, provision of technical support, and supply of information required for successful implementation. In this case, for a country like Tanzania where there is no national wide coordination, geospatial initiatives stay at a danger of fragmentation. Thus, in the study, there is a need to understand where implementing partners get such technical, coordination, and informational support regarding geospatial technology.

Caron and Bedard (2002) based on case studies present the lessons on the implementation of geospatial information technologies within organizations. They found that implementation was non-efficient, unforeseeable and technology drives rather than being rational. While they agree that success is subjectively interpreted, they connect success with higher improvement of information technology (IT), user satisfaction towards the technology, and availability of technological solutions in case of need. From the study, one learns that availability of supportive technology, especially ICT, perceptions of usefulness (which leads into satisfaction), and availability of technical support may significantly contribute towards successful adoption and use of geospatial techniques.

2.6. Challenges in Adopting and Using Geospatial Techniques

While there is a great value attached to the use of GIS and geospatial techniques, these innovations are not challenges free. In both developed and developing countries, the literature does not show where the adoption and implementation of geospatial technology was a 100

percent successful. Even in the US where GIS is well promoted, challenges of different types exist.

The study by Meeks and Dasgupta (2005) identify accessibility of data as one of the challenges that affect the adoption and implementation of geospatial technologies. In addition, there is a challenge with diffusion of geospatial skills in organizations, which limits quicker and uniform adoption. As one may agree with the views of Baker and Witham Bednarz (2003), the mix of professions and levels of ability to learn among employees in organizations pose a challenge to organizations. While the dream of organizations is to see quick results, this may not be a case for geospatial methods especially in organizations, which are not well trained in ICT. One needs to note that geospatial methods are computer and ICT supported. Therefore, for some of the organizations, instead of struggling with the technology itself, people are still at the stage of learning computer.

Caron and Bedard (2002), in his study found that even where organizational teams are determined to support the adoption and implementation, the success might be challenged by organizational contexts. These contexts include organization objectives, pathway, and operations. This implies that the more an organization has objectives and operations that accommodate the use of techniques. In relation to pathway, when the adoption was not made official, chances for successful implementation become limited. However, the study neglects the point that any changes regardless of their usefulness are not easily welcome. Innovations may have sufficient support at national and corporate levels, but loose support at users' level.

Connected with technology, capacity and support, there are other commonly cited challenges in the process of adopting and using geospatial techniques. Some of the challenges are more critical in developing and low-income countries. These include lack of reliable internet, limited access to training, lack of resources to obtain computer hardware and software. Accessibility of geospatial and other technology and research software is a well-noted problem in developing countries such as Tanzania. In such situations, even if staffs are committed towards supporting use of geospatial techniques in their organization, their motivation faces reversal due to lack of software, internet, and computers. Therefore, in relation with this study,

there was a need to understand the challenge that planning and decision-making staff have experienced. The study will pay more attention on factors including availability and accessibility of computer software and hardware, skills, technology, as well as the encouragement and support from organizations.

2.7. GIS Usage in HIV/AIDS Health Programs Implementation in Tanzania

The use of GIS in Tanzania appears to be popular in two main sectors mainly urban and land use planning and geological exploration as well as monitoring differences in weather and climatic changes while its use in public health programs remains at its infant stage (Hoffman, Melesse, & McClain, 2011; Wang et al., 2005).. Tanzania received GIS as part of the wider global IT developments to which no country could claim permanent exception. One important reason for the acceptance of the adoption of GIS technologies in Tanzania appears to be the unescapable demand from donors and development partners (Kundi & Ngereja, 2003). This is to suggest that GIS is a received technology of which successful implementation could depended more on its utility.

There are evidence of increased diffusion of GIS techniques and methods in the management of health services in the 2000s and 2010s. This is a time when the government through the Ministry of Health and Social Welfare (MoHSW) supported by development partners such as the Tanzanian German Programme to Support Health (TGPSH)/*Gesellschaftfürtechnische Zusammenarbeit (GTZ)* started piloting the use of the Global Positioning System (GPS) in health services monitoring (Schweikart, Henke, Masumbuko, & Poppschötz, 2008). However, much of the use in the health sector through the 2000s related to the collection of geometry and attribute data for the health facilities in the country, which resulted into setting up the national database that provide information on the health facilities and their operational status using the coding system.

Specifically on the USAID, the GIS technology had not been a priority since it started to support HIV/AIDS relief programs in Tanzania in 2003. delivery DSM, but has more regions and thus the scarce resources available need to be prioritized. With the increased financing of

HIV/AIDS relief support activities in the areas such as nutrition under contexts marked by scarcity of local resources and irrational spending (Swiss Development Cooperation, 2009; Tripp, 2012), there was an increased need for new strategies for ensuring cost effective use of resources to achieve desired outcomes. The emphasis on geospatial technology came under these contexts.

Regarding the use and information collected by the USAID HIV/AIDS projects implementing partners, there is evidence that GIS has not come to its full utilization. The information collected related to the spatial distribution of HIV/AIDS care and treatment in order to facilitates delivery of ART, VCT, and PMTCT services to the areas where they are most needed. This is because the methods including the use of balloons and numerical data as well as colours on the maps allow the implementing organizations to make distinction regarding prevalence, new infections, and mortality across geographical locations in their target sites. Equally, the implementers collect information that should aid the in HIV risks' monitoring, which helps in the identification of populations in an urgent need of HIV/AIDS prevention and awareness services (Anderson et al., 2014). Since the organizations need information for justifying resources allocation, they were most concerned with HIV/AIDS services availability monitoring to avoid deploying resources where there are alternative supporters {USAID, 2014 #1763}. Further, it has been identified that GIS methods help implementing partners in determining the key determinants of the rate of infections, geographical locations, and the most strategic areas for health education (Mayala, Mshana, & Mboera1, 2012). Overall, the use of GIS related technologies has predominantly been about locating the priority needs for financing prioritization and deployment of resources including finance, manpower, and medications guided by evidence of the numbers and severity of the problem in identified and defined geographical areas.

While the use of GIS is identified with an increased capacity to collate HIV/AIDS interventions with addressing intervening problems such as poverty and food insecurity levels in the areas that the USAID HIV/AIDS programs continue to direct its efforts, there are some key challenges that have been identified. The common challenges include the readiness to

implement the changes, limited access to GIS training, and limited capacity of the staff among the implementing partner organizations to use the GIS and related technologies (USAID, 2014). Other limitations include awareness, data quality, and lack of GIS professional training programs as the previous studies had identified (Hoffman et al., 2011; Kundi & Ngereja, 2003). This raises the need for an in-depth analysis of the contexts that surrounds the implementation in terms of both individual staff and their organizations.

2.8. Conceptual Framework for Effective Adoption of Geospatial Skills

The conceptual framework for this study was developed based on the review of literature. As the model in figure 2.1, suggests, successful introduction and adoption of geospatial methods in the context of resources allocation is dependent on different factors. First, there should be a support from the organization. In the model, the assumption is that, adoption support is largely provided by the organization (Baker & Witham Bednarz, 2003). This may include training; aligning the innovations with the vision, developing a strategy, and making employees participate in governing the innovations.

Integration with organizational vision implies making the technology and invention a strategic tool for desired success. For example, in case resources allocation planning, the organization should see the need for building capacity of decision makers and planners so that the right amounts of resources are directed towards the right number of the people (Bergquist & Rinaldi, 2010). However, it is prerequisite that decision makers should be well trained, motivated, and included in the governance and management of the desired innovation. This is because, when people are not equipped with skills that accompany transformational interventions in organization, it is obvious that implementation may be negatively received and thus result resistance.

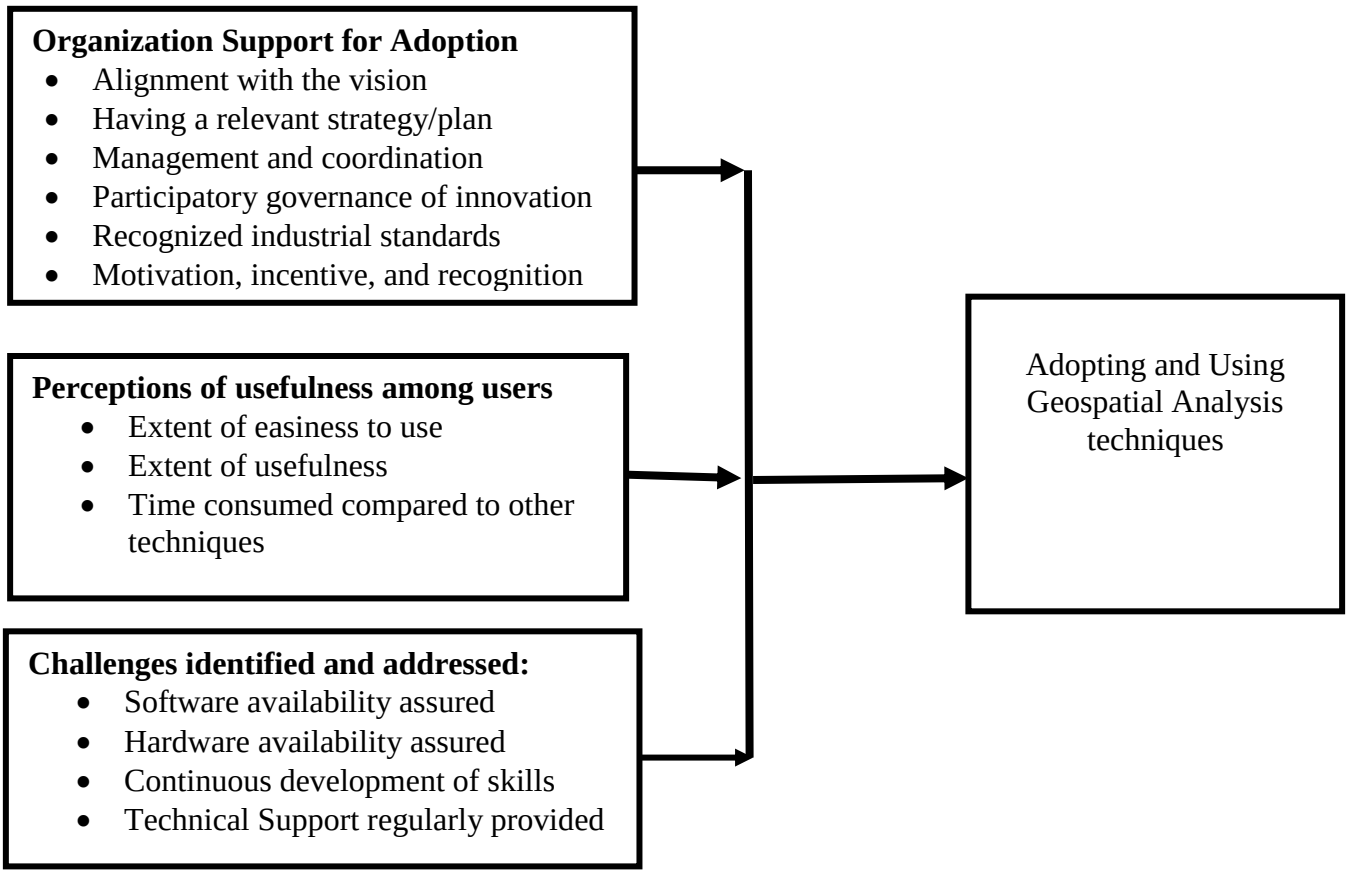


Figure 2.1: Conceptual model for adoption and use of geospatial techniques

Source: Designed by the researcher based on the literature

The second necessary set of factors relates to perceptions of how useful the innovation is in relation with employees own job. Employees are likely to resist or reject using the innovation if the think it does not help them serve time, make job much easier, or increase their capability to make their job result more improved compared to the alternative methods and techniques in use. Equally, it must be able to save the time they would spend when they use other methods.

The third selected factor is continuous identification and elimination of challenges, which may make the adoption and implementation less successful. In this case, it may include resources needed to maintain the hardware and software used in geospatial analysis, as well as internet and other ICT technologies needed (Bergquist & Rinaldi, 2010). Challenges may also be

related to skills. In this respect, success requires developing skills through both organizational and personal efforts in terms of continued learning and practice (Moise & Kalipeni, 2012). In addition, people are likely to learn and adopt new skills if the environments around them, the context supports learning (McCourt, Alarkoubi, & Bana, 2006; Mutahaba, 2011). Thus, removing challenges also extends creation of environments where there are motivation, teamwork, and promoting innovation and talents in the workplace. Because of continuous coordination and support, of the adoption, users of geospatial methods would be able to adopt and sustain use of geospatial techniques as they approach different problems to decide.

CHAPTER THREE

3.0 METHODOLOGY

3.1. Type of the Study

This research was a qualitative study. Its aim was to examine how planners and decision makers from implementing partners in the USAID HIV/AIDS projects in Tanzania consider geospatial methods to be useful in their day-to-day planning and decision-making, which inform resources allocation. A qualitative approach was preferred over quantitative since as Tuli (2011) argues, it allowed the researcher to conduct in-depth analysis of the processes and understand the context that surrounded the adoption and implementation in the study organizations. It sought to understand experiences and challenges that decision-makers associate with the adoption and use of geospatial methods.

3.2. Study Design

This study adopted a cross sectional case study design, which aimed at examining how geospatial technology and techniques users who had been identified and trained were able to adopt and implement the use of geospatial data and geospatial techniques in their day-to-day work. The study's concern was specifically on the use of geospatial methods in planning and deciding on the criteria for allocating resources including finance. A case study is appropriate for research that seeks to get deeper insights of processes in their natural settings (Stake & Savolainen, 1995; Yin, 2012). Therefore, USAID HIV/AIDS implanting partner organizations in Dar es Salaam were selected as a case for collecting detailed information on the experiences and challenges that of planners and decision makers in these organizations have encountered. The choice of these organizations was because, by virtue of being implementing partners, their staffs who were responsible for planning and decision-making were identified and trained on how they would use GIS to improve resource allocation, plans, and decisions.

3.3. Study Area

The study was conducted Dar es Salaam, Tanzania where the implementing partners who were trained were trained were located. The partner organizations had benefitted from trainings on GIS, which were conducted by the researcher. They received relevant skills that which were expected to improve their resources allocation decisions making. Those skills related to the processes including mapping of the HIV/AIDS prevalence, prevention services, and transmission hotspots. Therefore, the selection of Dar es Salaam as the study area was because the target study respondents and their organizations were all located in Dar es Salaam.

3.4. Study Population

The study's target population included individual decision makers who participated in making decisions related to resources allocation and received training on the use of geospatial technology in supporting their day-to-day allocation decisions. Therefore, all the 30 employees who had been appointed by their organizations as GIS champions and received training under the support of the USAID HIV/AIDS projects were part of the study's target population. Taking trainees who had worked as GIS champions in different organizations was important since it allowed the researcher to get a broad range of experiences related to the adoption and implementation of geospatial techniques use after the initial training.

3.5. Sample Size and inclusion criteria

The number of respondents who were expected to participate in the study was 30 based on the number of GIS champions who were trained. Only respondents, who had participated in the initial training, were still working with their organizations up to the time of the study qualified for participating in the study. On the other hand, trainees who were no longer employees of the implementing partner organizations up to the day of the study could not qualify for inclusion. The selected respondents were therefore those who had participated in the GIS training, working in positions related to resources allocation planning and decision-making, and were ready to consent for participating in the study. To the end, only 28 respondents in 14 organizations qualified for the selection. This was because two of the 30 trainees had left the

implementing partner organizations and joined other employers. Therefore, they could not fairly provide information related to their previous employment, which apart from the day-to-day experiences of using GIS techniques included information on motivation, encouragement, and support from the organizations.

3.6. Data Collection Methods

The study used two main methods of data collection. These were individual in-depth interviews and Focus Group Discussions (FGDs). The two methods and closely related questions were used for the same respondents. This helped the researcher to verify information from individual interviews. In addition, group environments helped the researcher to understand areas where there were consensus and disagreement between respondents.

3.6.1. In-depth interviews

These are direct, unstructured formal interviews on basis of one-to-one. This method included all 28 respondents. The researcher used an interview guide to conduct interviews with the 28 respondents. Since the research in person conducted all the 28 interviews, probing questions and additional descriptions on the questions were conveniently asked depending on responses of the respondents. The length of each interview was 45 to 50 minutes.

3.6.2. Focus Group Discussion

Out of the 28 respondents who interviewed, 14 respondents were invited for participating in FGDs. The aim was to make sure that each of the organization is represented by in the FGD. Therefore, for each of the 14 organizations one respondent participated in the FGD. At average, the FGDs took 70 to 90 minutes each. The FGDs were guided by a specific set of questions, which the facilitator introduced and kept asking probe questions to keep the discussions focused. Apart from using FGDs as a data collection method that understand the shared feeling about the implementation of the GIS technologies in their organizations, it served a triangulation role, which helped to cross check and validate the information collected using individual interviews.

3.7. Data Analysis

All interviews and FGDs were recorded in Kiswahili, transcribed, and translated into English. After examining the transcripts, data were coded against predetermined thematic concepts, which served as a codebook for further analysis. Interview and FGD notice were manually examined to find out which information was associated with, which themes. In addition, new important messages, which were not in the conceptual framework, were identified and examined in detail to identify where they fit. The researcher examined how the messages fit together and developed descriptive narratives in relation to the research questions and objectives.

3.8. Pre-Test of Data Collection Instruments

Interview and FGD questions were approved by the supervisor pretested using two different people who were conversant with GIS and allocation planning. The aim was to find out whether the questions were clear, consistent, and unambiguous. The questions, which had ambiguity were identified and reworded to make sure that they were consistently understood. This enabled the researcher to improve the questions before the actual fieldwork.

3.9. Ethical Considerations

The researcher conducted the study with utmost adherence to ethical procedures. Ethical approval for this study was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS). After internal approval, the permission to conduct meet respondents was granted by the management of implementing partner organizations before the start of data collection. The researcher made sure that all respondents signed a written consent form before participating in the study and assured respondents of confidentiality, anonymity, and freedom to refuse some of the questions or drop from the study at any time they wished to do so.

In addition, the researcher agreed with the implementing partner organizations to continue supporting the process of mentoring individual employees who would be selected for GIS capacity building in the future. Before the beginning of the formal coaching and mentorship, the researcher arranged to offer a two full-days training for all the employees from the

organizations, which participated in the study. This will ensure that both the researcher and organizations, which participated in the study mutually benefit from the study process through developing useful knowledge and skills.

CHAPTER FOUR

4.0 RESULTS

4.1. Introduction

This chapter presents the results of the study in relation to the three research objectives. Our presentation of findings is structured in thematic areas that address the main research objectives and research questions.

4.2. Characteristics of the Respondents

The study included 28 respondents from 14 organizations, which were USAID HIV projects implementing partners. The distribution of respondents by sex differed across the organizations depending on the persons who had appropriate information as shown in table 4.1.

Table 4.1: Distribution of respondents by organizations and sex

Organizations	Males	Females	Total
Family Health International	2	0	2
Tunajali	1	1	2
EGPAF	1	1	2
Red Cross	0	2	2
Pathfinder Int.	1	1	2
PACT	2	0	2
AMREF	0	2	2
PATH	1	1	2
Kihumbe	1	1	2
FHI Roads	1	1	2
Baylor International	2	0	2
EGPAH	1	1	2
Selian	1	1	2
Africare	2	0	2
TOTAL	**16**	**12**	**28**

Source: Field data, 2017

As table 4.1 shows, in eight of the partner organizations the decision makers who were trained in the use of geospatial techniques included one male and one female employees each. Four of the organizations had male respondents who qualified for inclusion in the study while two had only female respondents.

Findings from this study reveal the importance of considering sex difference since the male and female respondents had different perspectives on their role in the use of GIS technology and geospatial techniques. Equally, there was difference on whether it was easy to adopt and use in their day-to-day work. Our interviews revealed that most of the women thought that in organizations like theirs, it was not fair to tell a woman to use GIS as it will make her concentrate on the computer even after work time while they have to take care of the families.

While some of the women thought GIS required them to carry computers wherever they go, which they could not afford, others thought it was a responsibility of the employers to give them laptop computers, which are very small and portable if an employer needed them to concentrate on learning and using geospatial techniques. This presents a notable difference in terms of the general perspectives towards GIS where GIS was seen as relevantly a male friendly technology. The same perspective may be used to explain difference between men and women in the majority of the organizations. That would be one of the reason why women who were selected by employers as GIS champions were few compared to men. This section is structured in three main thematic areas reflecting the specific objectives of the study.

4.3. Organizational Initiatives to Support Adoption of GIS

The first study objective was to examine the initiatives that were in place to support the adoption and use of geospatial techniques by employees who were trained and their job needed geospatial techniques to support resources allocation decisions. Based on the existing literature and the study findings, the study considered six specific thematic areas under this objective. These were the alignment with the vision, having a relevant strategy or plan that guided adoption and use of geospatial techniques, management and coordination, participatory

governance of innovation, recognized industrial standards, and last, the motivation, incentive, and recognition. To address this objective, the following areas are presented in details.

4.3.1. Having a relevant strategy for GIS

Having in place a strategy or plan for adoption and implementation of an innovation play a significant role in the success of the innovation. Overall, the study found that none of the organizations had a strategy or a plan for adoption and implementation of geospatial technology. Ten of the 14 organizations had strategic plans that guided their operations. Seven of them identified the use of innovative methods as a key to their success, but none of them pointed out specifically at geospatial techniques and technology. The quotation from one of the interviewees illustrates:

"In fact we need technology and we have been using it. We understand that without technology, we cannot work better in in this age of science and technology, but we use it as longer as the need arises. It is not necessary that we write everywhere that we are using technology while it is part of our day to day operations" (In-depth interview, 18 January 2017).

Our findings show that technology adoption may not necessarily be part of the strategic direction of the organizations, but rather a contingent process where the need arises. The findings reveal that the initiatives to support the adoption and use of GIS in these organizations was not born within the internal operations, but rather imposed as part of the conditions for successful implementation of projects. That is why the organizations could not specifically identify GIS as part of strategic direction.

4.3.2. Management and coordination

For all 28 respondents who participated in the study, appointment for attending the training followed a formal procedure. They all reported to have agreed with their immediate superiors that they would be supported by the organizations by making sure that they receive regular training and they are provided with standard software and hardware for the implementation.

However, the majority thought that their organizations did not effectively manage and coordinate continued support throughout the adoption and implementation. This position was evident through the following response:

"We started well. They appointed us for the training and told us that we are going to be GIS champions. We thought they would support us by providing us with laptops and GIS software, but as time went on they slowly forgot their role"(FGD, 14 January 2017).

On the related point, another respondent had the following comment:

"For us [women] you need someone to insist you to use these things. You need a laptop, especially a smaller and portable one. What they did here they only bought desktops. Our boss who left was the one championing the process, when she left everything stopped. We use maps, but it is not compulsory [In-depth interview, January 17 2017).

Our finding shows that while there was prior support during the start of the adoption process, its continuity was questionable. The process of implementing geospatial technology lacked a continued support from the management of the organizations and thus resulted into reduced pace of implementation.

4.3.3. Participatory governance of GIS innovation

Another factor for successful adoption and implementation of technological innovations is making employees effectively participate in the processes such as planning and identifying potential challenges and addressing them. Related to that, the study found that participation was not sufficient for all the partner organizations. The need to adopt and use geospatial technology came from the donors. Therefore, the implementation was affected by limited ownership and participation of employees in the partner organizations.

Majority of the respondents felt that limited resources also affected their participation. This was illustrated by one the respondents, who emphasized the effect of limited resources on successful participation:

"If I had my own money I could buy my own laptop and install the software on my own. You know what? We like it, it is very interesting, but its cost is big. It is very difficult for a person

to buy both a computer and software on his/her own. I think the organizations needed to support us" [FGD, 11 January 2017]

From the findings, it is worth to learn that compared to the implementing partners, the USAID, which was the funder had a more interest in the use of geospatial technology. The USAID needed implementing partners to ensure that allocation of resources is well-planned and cost effective. That is why the implementation received limited participation when it came to individual partner organizations.

4.3.4. Availability of recognized industrial standard GIS software

Users may feel encouraged to sustain the usage of geospatial techniques if they were being supported to access and use recognized standard software, and hard ware. The study also sought to know whether employees who were geospatial technology champions in the partner organizations had access to recognized standard software and hardware.

Nearly half of the respondents felt that it was difficult for them to attain high speed computers on which the GIS software could run effectively. After training, the organizations rarely supplied software once an employee changed a computer. As many of the users relied on a few computers, which are owned by their organizations, even those who felt that they would learn on their own and use more advanced versions of the GIS software failed. This can be illustrated by the following quotation:

"I remember the facilitators installed it [GIS] on my laptop. I had it for some months. When my laptop crushed down, I have acquired an advanced version of the software. I had to go back and use the one that was running on a small computer in the office. This one was too slow and discouraging" [In-depth interview, 18 January 2017].

This finding shows a limited availability of standard software and hardware for the users. As a result, very few could purchase hardware and software on their own. Consequently, there were more limited chances of having people who were trained training others. This can partly contribute towards limited adoption and usage of geospatial techniques among the implementing partner organizations and their GIS champions.

4.3.5. Motivation, incentive, and recognition of GIS users

In the process of adopting a new technology, motivation, incentives, and recognition of the early adopters are important success factors. The study therefore sought to explore whether there were initiatives to motivate, incentivize, and recognize people who took a leading position in the adoption and implementation.

The study found that there were no formal motivation arrangements for encouraging users to continue using GIS in all the 14 organizations. However, respondents from three of the organizations acknowledged that their superiors encouraged them to use GIS and congratulated them when GIS and population data supported their decisions. One of the respondents from one of the organizations remarked as follows:

"I had a boss who liked it very much. Every time I used population data in my plans and reports, the boss would encourage me. He usually told me he liked the way I was doing it. I also felt better whenever I was told" [In-depth interview, 22 January 2017.

Another respondent had a similar view, which is reflected through the following quote:

"There was nothing they could give me, but I always felt very happy whenever my efforts to learn were appreciated. I guess it contributed to my current success" [In-depth interview, 18 January 2017.

The findings illustrate that the employees who were quick in learning geospatial techniques needed recognition. This is because those who took personal initiatives to learn and use GIS felt satisfied, especially as possessing rare, but high demand competencies. They also felt proud as geospatial techniques gave them more confidence to carry out their job responsibilities. However, only four organizations had some record of recognizing those who were good geospatial technology users.

The study found that the organizations had clearly stated visions, which appreciated the use of technology in the development of the organizations. However, none of organizations felt that the visions and missions should articulate the need for utilizing GIS as a priority in the organizations. However, eight of the organizations' vision statement directly expressed the use

of innovations and modern technology to enhance performance. From the interview, one of the respondents thought geospatial is a minor thing, which was too small to be part of the organizations mission:

"We are aware of these things [geospatial techniques] but our mission has always been there. We recognize that it is important to use those technologies, but we cannot see who we should be forced to make them part of our mission and vision. Geospatial techniques are not a big thing that must appear on our every document" (FGD, 11 January 2017)

Our finding shows that the organizations recognized the importance of geospatial technology. However, some of the respondents thought that such importance should not be overstated, as their organizations may not regularly amend their visions to include geospatial techniques as a priority.

4.4. Decision Makers' Experience on the Usefulness of Geospatial Techniques

Further, the study sought to explore the experiences of decision makers regarding the usefulness of geospatial analysis techniques in supporting resources allocation plans and decisions. Interview and FGD, which related to this study objective focused on understanding job activities, which respondents carried out, and which of the activities utilize maps and information on the maps. In addition, respondents were asked how they considered maps useful in their day-to-day resources allocation process. Four selected areas were considered when examining the responses related to this objective. These were the relevance to the job, the easiness of use, the extent of usefulness, and the time consumed compared to other techniques.

4.4.1. Relevance of GIS to employees' job

To understand the relevance of geospatial techniques and methods, there was a need to first understand the job activities performed by different respondents. Majority of the respondents were employed as field personnel whose job description varied. However, the activities

commonly related to marketing of the programs, needs analysis, and identifying groups, which are needier. Five respondents were also engaged in developing new proposals to be incorporated in future programs, developing budgets, and prioritization of the most important geographical and demographic areas of interest for the programs. Commonly, all the respondents reported that they were responsible for writing reports in which the majority felt it was important to include maps.

According to the respondents who participated in the FGDs and interviews, one of the most common features in their job activities is the need to satisfy the funder that resources would target the needy and would be used cost-effectively. In doing so, proposals and implementation plans must be persuasive in nature. One of the best tools for persuading the donors is showing them the logic behind spending much on a certain section in the population and spending little on the other sections. As some of the respondents explained, this is effectively done using GIS:

"I like GIS since you can pull up a map, show where the population is much affected by a certain health problem and justify the decision to spend more on that population. You know, you may also show the funder that there is an alternative funder in the area so you don't need to concentrate your efforts there" [FGD, 11 January 2017]

In the same line of argument, another respondent had the following to say:

"Americans want to know why you should spend their money on a certain area and not the other area. You use mapping information to convince them that spending on a certain geographical area might yield better results compared to the other areas. That is why we cannot completely do away with GIS" [FGD, 11 January 2017]

In relation with these quotations, which show that planning and deciding on resources allocation demand use of GIS, the findings show that geospatial techniques are relevant for decision makers. The relevance comes in when decision makers and planners are required to justify how much should be spent on a certain population compared to another. Moreover, it is

more important if planners and decision makers want to persuade decision makers that their allocation plans and decisions are reasonable and rational.

4.4.2. Flexibility in learning and use

Among other things, the study sought to understand how the employees considered both learning how to use and the actual use of GIS was an easy task to them. In response to this question, majority of the employees thought it was easy as any person could learn it and use it regardless of being a specialist in related technologies. One of the respondents had the following remarks:

"I find it easy to learn and use because I did not have any prior knowledge of GIS, but when the facilitator introduced it I leant and started using it. It is very friendly and I liked it" [In-depth interview, 22 January 2017]

In the same line of argument, another respondent during the interview said:

"In the beginning I had great worries that GIS was a big thing to learn and understand…When I started I found myself getting in love with it. I used it all the time when my computer was working [In-depth interview, 22 January 2017].

Apart from easiness in terms of learning and using, some respondents pointed out aspects related to easiness in terms of accessibility. Majority of the respondents who were interviewed thought that both GIS data and GIS software were not easily accessible. For example, one of the respondents who had struggled hard to access the GIS software had the following to tell:

"I tried hard to access the GIS data, but I think for me it was a business that I could not afford. The software itself is not easily affordable and you know you need a software to access the data that we need to use" [In-depth interview, 26 January 2017].

The findings in this context show that despite the relevance, the respondents perceived accessibility of GIS software and data as somehow difficult. In addition, one of the respondents reported that she had personally tried hard to learn the use of GIS data and software with little success. For her, *"it was not any easy task like using a smart phone, which*

many people associated with GIS" [FGD, 14 January 2017]. For her, it needed intensive training from competent and well trained facilitators.

4.4.3. Extent to which GIS was useful

Related to the extent of usefulness, the researcher explored how respondents thought they benefited from the use of geospatial techniques and geospatial data in their day-to-day work. Majority of the respondents agreed that they felt that GIS was useful in their day-to-day job activities. However, the majority of the respondents recognized the fact that limited accessibility of the technology limited their chances to learn and become competent in using the GIS technology. In this respect, while respondents agreed that the GIS technology was relevant and useful in their work, they recognized the accessibility, cost, and limited support from their organizations as the main limiting factors for effective usage of GIS technology in their job activities. In support of this argument, one respondent illustrated that:

"When you have GIS your work is easy and interesting…the only danger is that you will get it when they are training you. When you are well-set, you find yourself not having it [GIS] you will ask your boss to buy one for you, but he will never. I think they don't buy it because it costs a lot of money" (In-depth interview, 22 January 2017).

Furthermore, respondents pointed out two different scenarios that affect the perceived extent of usefulness of GIS technology in their work. First, more than a half the respondents felt that they were not motivated to learn GIS techniques, as they would not expect to use it anywhere else including their private lives. Secondly, some of the respondents thought that they had no reason to invest in an expensive technology that they do not need for the development of themselves and their families. Therefore, they felt that it was best for them to do "as usual provided that it does not affect their income". Therefore, from the findings, one may observe that the biggest problem that affects the perceptions of usefulness is lack of foreseen motivating factors.

4.4.4. Time consumption

Related to whether the use of geospatial technologies was time consuming compared to other techniques that employees used to collect and present data, respondents were not able to show that they find any kind of relationship between time taken and the methods the used. However, some of the respondents who were interviewed thought that GIS and its related technologies could serve time that employees use in synthesizing, analyzing, and understanding the data before using them to support decisions. However, in fact, respondents thought that it requires special skills to benefit from use of geospatial techniques. Related to this point, one of the respondents made the following comment during the FGD:

"Those like me who were born before computer find it time consuming to use GIS. Indeed, it needs people who are computer literate and are good in the language, which is used there. If you do not understand it you will take too long struggling to make sense out of what it is telling you" (FGD, 12 January 2017)

Precisely, the study shows that a well-trained and experienced user of geospatial technology would use very short time to pull out and assemble GIS data to communicate out the intended message. On the other hand, employees who lacked experience both fatigue and likelihood of making mistakes in the interpretation of GIS data. As another respondent argued, some potential users found it best for them to avoid GIS since they are likely to use a lot of time gambling with what they cannot understand.

These findings show that some respondents perceived GIS and geospatial techniques as more time consuming compared to other methods. However, the time consuming nature of GIS comes because of limited competencies and insufficient training in GIS and other relevant skills including ICT, computers, and language. They rather thought that a person who is well-trained in geospatial techniques would reduce time by quickly understanding and using available population data to reach the right decisions.

4.5. Main Challenges Associated With the Use of Geospatial Methods

The study further sought to analyze the main challenges that the respondents encountered in the process of adopting and starting using GIS related techniques, especially after the initial training. To get relevant experiences, respondents were asked to identify a minimum of three challenges, which they experienced as GIS champions in their organizations. Respondents identified a number of challenges that we could saliently classify six thematic areas, which are inclusive.

The areas that could inclusively accommodate a diverse list of challenges in order of their importance were as follows. The first challenge related to limited support from the organizations. The second was the high cost of the GIS technology. The third was thelack of sufficient skills that GIS technology demands including computer and ICT skills. The fourth was the inconsistencies that users have experienced in the change and development of the GIS technology itself. The fifth was limited availability of the GIS software. The seventh and last was the general lack of learning culture in the respondents' organizations. Let us now focus on each of these challenges.

4.5.1. Limited support from the organizations

From both interviews and FGDs, respondents reported absence or presence of little support from the organizations as the most important challenge that affected adoption and usage of GIS technology in their organizations. Many of the respondents felt that organizations had limited commitment towards making GIS an important tool for simplifying their work. In most of the organization, support was limited to selection of GIS champions and introducing them to the trainer who was a researcher. Thereafter, little was made to either know whether the trainees had gained required competencies or not. In connection with this, one respondent had the following to say:

"when we send our children to school, when they come back we ask them what they have learnt. It is from this point we become able to know whether they got what we expected. But in my organization this did not happen. We received training on GIS when we went back nobody bothered to ask me what I had learnt" (FGD, 14 January 2017).

Similarly, there were experiences of little support from the top management of the organizations. Most of the respondents explained that the GIS related learning and implementation initiative remained a peer-to-peer process, which received no enforcement from the top managers and most of the supervisors. Indeed, in all the organizations GIS became neither a strategic tool for improving performance nor a formal requirement in the process of personal development. A respondent in the FGD had the following illustration in relation to this argument:

"In our working environments you all know we take everything after being forced to take them. The only thing that the organization adds on my side and I never complain is salary increment. Therefore, my expectation was that our bosses would stand in it and tell us to make sure that we learn and use GIS as a condition for employment…indeed this has not been a case for most of us" (FGD, 12 January 2017).

In addition, respondents reported that the introduction of GIS implied a financial burden on the employees since the organizations could not give them the financial requirements they needed to obtain and maintain GIS. Many of the respondents felt that installing GIS software on their computers meant that once the computers collapse or are stolen the organizations would be ready to give them other computers or buy them reinstallation software. However, this had not been a case in all the organizations. Related to this, one of the respondents commented:

"How can I buy my own computer and someone comes and install their software, but when the computer dies or collapses no one cares? I had always been kind and generous to the organization. I used my computer to work for them, but when the computer died, nobody helped me. Could I buy another computer and help them to buy the GIS software?" (In-depth interview, 12 January 2017).

The findings in this respect show that the organizations had little support of the GIS technology adoption. Employees were left to invested much of their personal efforts with little acknowledgement from the organizations. There was little support in champion the implementation, supervision, and financing the basic costs of GIS technology.

4.5.2. The high cost of the GIS technology

The cost of obtaining and maintaining GIS was also identified as a challenge in the adoption and use of the GIS technology in the study organizations. Many of our respondents reported that they failed to buy GIS replacement software because of the big cost that GIS requires. One of the respondents illustrated this by saying:

"in the beginning I thought its cost is the same as a normal antivirus software, which costs something like 30,000 or 50,000 Tshs. When I asked in the computer accessories and IT shops, they all said they did not have. When I asked prices online, I found it was more than 1000 USD, which is more than two times my monthly salary. I think that is why the organizations could not buy them" (In-depth interview, 12 January, 2017).

In addition, adoption of the new technology imposed cost on the employees, as they have to buy computers, buy software, and keep them updated. One of the respondents reported that since GIS skills were important for him, he could not run away from the cost of obtaining more training on GIS. Therefore, he had to hire a GIS expert who was paid 10,000 per hour to train him. In addition, successful implementation of GIS, some respondents were to buy pirate software at lower costs, which ranged between 50,000 and 80,000 shillings. These findings show that not all the GIS champions who were trained would be ready to bear the cost of GIS as it is perceived as a responsibility of the organizations.

4.5.3. Lack of sufficient skills that GIS technology demands

The study demonstrated that lack of sufficient skills that GIS technology requires posed a challenge in the adoption and use of GIS. Majority of the respondents had view that the training, which they received, could not sufficiently allow them to use GIS. The GIS champions received a basic and short training, which was not enough for them to master and

train others as the plan was in the begging. To illustrate this, one of the respondents provided the following remarks:

"We were trained on the basic features and methods of GIS. Most of us think when you use maps is GIS and our skills are only limited to the use of maps in our reports. Sometimes, we cannot even locate the information on the map. I think we need more skills. We need additional training" (FGD, 14 January 2017).

Apart from GIS software specific skills, the majority of the respondent lacked additional auxiliary skills that would help them quick learn and master GIS technology including computer and ICT skills. Majority of the respondents pointed out that computer skills, which were compulsory and must for GIS users was a challenge. Despite agreeing that GIS was not easy to learn, some of the respondents acknowledged that the difficulty in learning GIS most raised from limited understanding of the computer language. Many of the respondents could not even update the software when they had it on their computers. Four of the respondents were still having the software on their computers, but they could not execute the programs since the updates or individual program files, which they had backed up on their computers, were missing. In connection with this challenge, one of the respondents commented that:

"Those like me who was born before computer, we find it…indeed, it needs people who are computer literate and are good in the language, which is used there. If you do not understand it, you will take too long struggling to make sense out of what it is telling you. A person who knows computer will also know GIS" (FGD, 12 January 2017)

These findings reveal that in addition to the lack of strong and detailed GIS training, limited command of computer posed a challenge to the mastery of the GIS technology though both training and self-learning practice.

4.5.4. Inconsistencies in the GIS technology itself

As another challenge, the study noted that respondents experience inconsistencies within the GIS technology. According to many of the respondents, GIS is not a single integrated technology with a single software. Instead, it is dynamic; it has different software with

different features and versions, which are not compatible. In connection with this point, one of the respondents illustrated that:

"The software versions are so many and tend to change from time to time. One friend of mine who is an IT expert used to bring me software for other tasks such as research and editing music. I install them on my computer myself…for this one I can't since every time I try I get an error message that it is inconsistent" (FGD, 22 January, 2017)

In the same line of argument, another respondent had the following to say:

"I have tried my best to become a friend of ArcMap software. But the problem we have today is that the newer versions are characterized by behaving inconsistently, especially with the rectangular and vertical edits. I tried the ArcGIS for several times and found it always crushing. So I don't understand which software would be the best" (In-depth Interview: 11 January 2017).

The finding illustrates that technological dynamics and existence of many versions and types of GIS software make the mastery of GIS difficult. When there is a different version of the software, one needs a lot of learning and practices to be adopted to a new version. It is not like other data visualization software that commonly contains the same, but modified features for different versions. Therefore, mastery of GIS needs people who are always update with technological advances.

4.5.5. Limited availability of the software

Another challenge in the process of adopting the GIS technology was the limited availability of the GIS software. Most of the respondents had got the software installed on their computer during the training. When the computer systems crushed, most of them lost the software and could not get them back. One of the respondents illustrated this point by saying:

"I really liked GIS, but when my computer died off, it lived with it forever. Now that you are here, we are very lack we are going to get the software again. We have been trying to see if we can get someone installing it on our computers, but we could not get one" (FGD, 22 January 2017)

While many of the respondents lost the GIS software, some of them, especially those who had found GIS simplifying and improving their work were ready to procure the software on their own, but they could not. Some of the respondents reported to have gone through computer accessories' venders without success when they were trying to get the software back installed on their computers. One of the respondents who had spent some months visiting ICT shops and commercial programming technicians to get a GIS software made the following remarks:
"The problem is that even if you have decided to buy the software, sometimes you don't get them. I spent months and months visiting software installation technicians, but I could not get anyone who has a software. There was a time I got someone at Machinga complex who offered to install the software for me at a price of 50,000. When I installed it, I discovered it was not genuine. Indeed, I used it and discovered that it could not execute some of the functions. So, I used it within a short time and it got closed" (In-depth Interview 12 January 2017).

These findings show that there is a challenge of accessibility of the software. Many of respondents reported that even if individual employees or organizations are ready to buy GIS software, it becomes hard to get them since the availability of software in the local market is limited. Therefore, many users end up installing pirate software on their computers, which tend to crush within a short time.

4.5.6. The General apathy to the learning culture in organizations

Furthermore, the study found that adoption and use of GIS technology in most of the studied organizations is affected by existence of the culture that does not encourage learning and innovations. Most of the respondents' organizations had no spirit of encouraging their employees to learn new things, which in most cases resulted into being opposed to changes. In one of the interviews, the respondent had the following to say in connection with this argument:
"People are not ready to change and learn new things. We receive these behaviors from our top bosses and it becomes part of our organizations' life. We don't even recognize that these

important skills like GIS may be needed by future employers and thus place us in good employment. I see and interpret this as a habit in many of our organizations. We do not like learning and knowing new thinks" (In-depth Interview, 12 January 2017).

Related to the same point, another respondent remarked as follows:

"I agree with you, but I do not think if all of us dislike learning. There are people who are committed to learn and acquire new skills and knowledge, but when they are employed in organizations that cling on the old ways of doing things, we completely get lost. I think organizations contribute much on this. Learning needs a sort of motivation even if it is for the benefit of an individual rather than an organization" (FGD, 22 January 2017).

From these quotations, the study findings show that the organization culture of 'doing things as usual' contributed as a challenge by slowing the process of adoption of GIS. Generally, this culture is associated with discouraging and not valuing new discoveries, innovations, and not rewarding or appreciating personal efforts and sacrifice of time and resources by those to take a lead in the adoption of new technologies.

CHAPTER FIVE

5.0 DISCUSSION

5.1. Introduction

Increasingly, the existing knowledge shows that geospatial techniques provide the basis for rational and efficient deployment of limited resources, which need to be spent well in order to serve lives. In the Tanzanian context, USAID HIV/AIDS projects implementing partners were recommended to use geospatial techniques to improve resources allocation processes. However, little knowledge existed on whether decision makers consider geospatial methods relevant to their job activities as well as the challenges that they encounter in the adoption and use the methods and related techniques including maps.

The study sought to examine the use of geospatial analysis to support decisions related to allocation of resources in health projects where USAID HIV/AIDS projects implementing partners were selected as case study. The interest of the study was to determine initiatives (if any) that implementing partners used to support the adoption, to get users' experiences regarding the usefulness of geospatial techniques, and finally analyze the main challenges that users associated with the adoption and use of geospatial techniques in their job activities.

5.2. Organizational Initiatives to Support Adoption of GIS

The study results revealed that the organizations shown support during the initial stages of adoption, which included training of the GIS champions. The reason would be mainly that it was part of the requirements of the funder, which are usually attached to the availability of the fund. Indeed, the initiation and adoption of the GIS technology seemed to be largely a concern of the USAID rather than the partner organization.

The study found that in all the organizations there was no direct alignment between GIS technology and organization's visions. Despite the fact that GIS was strategically introduced to increase efficiency and effectiveness in resources allocation, performance improvement strategies of the organizations did not explicitly show that GIS was given importance. This

finding is consistent with the findings of the study by the FGDC (2014), which found that lack of clear strategy for guiding the implementation of GIS affected its successful implementation.

Further, the study found that the implementation of GIS was affected by lack of a relevant strategy in place. This findings support the FGDC (2014) study findings on the relationship between organization strategy and success of GIS innovations implementation. Another possible explanation of this finding would be in terms of difference in understanding the intention of GIS among the users, which is connected with lack of strategic initiatives to make GIS part of the day-to-day operations of the organizations.

In case of management and coordination, the study found that there was no formal structures in the organizations entrusted with coordinating the implementation of the GIS adoption process. Instead of taking programmatic steps to make geospatial skills part of individuals' performance, businesses related to GIS were rarely discussed and if they were discussed it was privately done between an employee and his/her superior. Given limited ownership and participation in planning, the GIS champion who was initially trained was not motivated to train others. This finding supports previous findings by Caron and Bedard (2002), that lack of engagement of top managers in the adoption of the innovation affected successful implementation. However, the striking observation in this study was that, some users had taken their own initiatives to adopt and use GIS despite the lack formal management and coordination. This may further explain the motivation to adopt and utilize GIS as a concern of an individual employee.

Regarding participatory governance of the GIS innovation, the study found limited and insufficient participation of the users in designing and planning for the implementation of the GIS technology. This finding is in agreement with the previous study by the FGDC (2014) that closer participation of the employees increased the motivation to take the leading role in the implementation of the GIS technology.

Regarding acceptable industrial standards, the study found that there was no guidance on what industrial standards are recommended by the organizations. Given the existence of many versions of GIS software, which serve different purposes, when employees lost their initial software, they could not know where to find software for their computer devices. This findings do not support the previous research by Bergquist and Rinaldi (2010), which showed that employees felt more determination to participate in the implementation of the GIS innovations due to freedom to choose from a range of existing technological products. In this respect, one would argue that even the control of choice might depend on the extent to which organizations are ready to bear the costs of financing software and hardware for individual users of GIS.

The findings of this study revealed that lack of incentives and acknowledgement of the leading users of geospatial techniques made the GIS champions loose motivation, which they had in the beginning. This finding supports the previous study by Caron and Bedard (2002), which showed that motivation played an important role in making employees successfully adopt and use a new technology. The possible explanation is that motivation brings a sense of ownership where employees feel responsibility for leading change. However, motivation appears to be contextual and controversially range from self to organizational motivation and from monetary to moral motivation. The reason would probably be the cost that managers attach to motivation.

5.3. Decision Makers Experience on the Usefulness of Geospatial Techniques

In relation with the users' experience of usefulness, the study findings revealed that majority of the users found geospatial techniques useful and adding quality to their work. For them, geospatial techniques increased professionalism in planning and making decisions related to resources allocation. They also found the necessity in that their organizations plans and reports are necessarily persuasive. Geospatial techniques enhanced persuasive power in the communication with the USAID. In this respect, the study findings support the observation of Balogun and Mutahaba (2002) who observed that the uptake of reforms depend on the perceived usefulness of the reforms to the users.

On the other hand, despite the relevance, the study revealed that the users found GIS and geospatial techniques uneasy to learn. First, learning needed more time, which as employed individuals did not have. In addition, it needed some allied skills in computer and ICT, which were also not the orientation of the majority of respondents. This finding is consistent with the previous research by Crampton (2011) who found that the mapping techniques were affected by the ability to learn and comprehend new technologies among the city employees. The possible explanation would be that the majority of the employees did not have formal training to provide them with sufficient computer and ICT skills. Therefore, learning GIS as a computer program may not be easy for a person who is not a well-trained computer user. This suggests that computer and GIS skills are interdependent.

The study has demonstrated that some respondents were quite interested in the use of geospatial techniques. They thought in organizations where there is a learning culture, geospatial techniques would be largely useful. The current findings do not support the previous research by Brewer (2005) who found that in organizations which do not encourage learning new techniques employees are less likely to take personal initiatives to learn new technologies related to GIS. The possible explanation of these results is that rather than thinking about increased training in GIS, organizations need to transform their culture and create environments for continuous learning. Indeed, this would necessarily need to involve having trained experts who may couch others through making GIS skills part of day-to-day operations of the organizations. However, the consensual position across the organizations was that for employees who are not well trained, the use of GIS and geospatial analysis techniques is likely to become a tiresome and time consuming exercise.

5.4. Main Challenges Associated With the Use of Geospatial Methods

The study findings show that there are different challenges that respondents have experienced throughout the processes related to adoption and use of geospatial techniques. The challenges range from the more organizational ones, which include lack of support, limited availability of the software and hardware to organizational ones, which include limited skills related to GIS itself as well as computer and ICTs. However, the pertinent challenges, which respondents

emphasized, were those that relate to limited support that employees experience in the adoption, learning, and attempt to sustain usage of GIS in their day-to-day work. Organizational support as a challenge overlapped with other challenges such as the cost of GIS hardware and software as well as building relevant skills for using geospatial techniques.

The findings on the challenge of limited support from the organization showed that despite the interest of employees in GIS, most of the organizations failed to provide a consistent support to make sure that employees learn GIS continuously as part of the day-to-day employment. This finding supports previous researches by Bossler et al. (2004), Ogrosky (2003), Caron and Bedard (2002) which found that successful adoption and use of geospatial technology depends much on the existence of a rational drive behind the adoption as well as strategically designed mechanisms to support the adoption and implementation of GIS. The possible explanation would be that organizations in which employees are not supported to adopt new technologies, the pace of self-directed learning is likely to be slow.

Related to the apathy towards learning, the study found that employees' interest in learning new ways of doing things was low. This finding corroborates previous research by Baker and Witham Bednarz (2003) who found that organizations which were swept into the use of GIS by the waves of technological advances without preparing their employees were less likely to succeed compared to those which rationally identified the need for adopting GIS and supported internal learning and innovations. Overall, the findings suggest that there is a need to make employees develop interest and ownership in new technologies before they are induced to the use of such technologies. Preparation of employees make them develop motivation to learn on their own and adopt new skills without external pressure.

Related to the high cost of the GIS technology, the study findings revealed that employees were not able to meet the cost of GIS since it was very high. The study findings support the previous research by Alesheikh, Helali, and Behroz (2002) who found that the high cost of GIS and existence of database specific software affected the adoption and utilization of the GIS technology despite the existence of GIS freeware on the internet. These findings suggest that the organizations, which are responsible for investing in GIS technology, could hardly

afford the cost of GIS as different software are used for different purposes. Therefore, the lack of a single integrated software for all geospatial analysis makes GIS a high cost technology.

Further, the study found that adoption and use of GIS was challenged by lack of skills that GIS technology demands, which included both GIS and computer related skills. This finding supports previous research by Baker and Witham Bednarz (2003) who found that the virtue of professionalism and the ability to learn are the key determinants of successful adoption of GIS. The findings generally suggest that organizations may invest sufficient funds in technological transformations. However, if there were no skills that the technology demands, success would be curtailed. The possible explanation would be that since GIS is a rare skill in Tanzania, very few people who possess GIS skills are available. Therefore, even training the GIS experts in organizations becomes a challenging endeavor.

In addition, the study findings revealed that GIS technology was consistently dynamic and thus experienced quick changes in the technology itself. Being the case, changes in the technology as well as usage of the information needed would need the organizations to make regular investment in GIS, which most of the organizations could not support. Similarly, this finding supports the earlier study by Alesheikh et al. (2002), which revealed that the GIS technology was characterized by quick advances, which challenged users to maintain a system of continuous learning, which aim at familiarizing themselves with new versions of the software. In relation with this study, the finding suggest that there is a close connection between the frequency of usage of GIS, learning, and possibility of successful adoption of geospatial technologies in organizations. However, the cost implications in terms of affording to employ trainers to train employees and buying GIS software need to be considered in line with advances and dynamics in the GIS technology itself.

The study suggests that in situation where organizations and their management take GIS as part of the skills that the organizations appreciate most, employees would be motivated to get such skills from the sources that are made available by their organizations and other training institutions. In the researcher's point of view, motivation encourages people to invest in themselves and invest in the knowledge that is on high demand. In this respect, one may argue

that the main challenges that would need closer attention by both the researchers and decision makers are the ones that relate to support, encouragement, and appreciation of those who stand as champions of innovations by organizations and managers.

5.5. Strength and Limitations of the Study

There are some strengths and limitations, which are worth to point out regarding this study. The first strength is that, respondents were down from 14 different organizations in the HIV/AIDS health programs implementation environments. They shared different experiences and practices, which were broadly considered in the analysis. Therefore, the contextual enablers and challenges that this study identified broadly represent diversity of practices in these organizations. This offers a broad range of experiences regarding the adoption and implementation of geospatial techniques, which may not be comprehended in one organization.

Secondly, the triangulation strategy, which involved the use of interviews and FGDs for the same respondents, contributes to increased reliability of the findings. In the study, the data from FGDs were used to verify the data obtained from individual interviews. For that reason, the researcher built more confidence that respondents represented experiences as would be observed by other researchers in the same organizational settings.

The pertinent weakness of the study was relying on pure qualitative methods, as a case study, which was mainly cross-sectional; the study could not be able to identify situations in other organizations in Tanzania, which may display different experiences. The researcher recognizes that there are social economic and demographic differences between Dar es Salaam and other regions. Therefore, despite the fact that the study involved 14 organizations, findings may not be generalized to organizations in other regions in Tanzania. Instead, lessons from experiences of the studied organizations may be useful in exploring adoption of GIS or related technological interventions in similar organizational contexts.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

The last two chapters have presented and discussed the study findings. This chapter provides the conclusion of the study. It also provides some key recommendations for future actions and research.

6.2. Conclusion

Based on the findings, the study's main lesson has been that employees recognize the need for using geospatial techniques to improve decision making on resources allocation. However, to the present, the adoption and implementation remains largely unsuccessful. The adoption and implementation of geospatial technology and techniques use in the USAID HIV/AIDS projects implementing partners was employees' led. The organization initiated the need for using geospatial technology in planning and decision making as a response to the call from the funder, the USAID. As a result, the adoption and implementation relied on internal, self-motivation of the GIS champions while there was little support, encouragement, and motivation from organizations and their management. This lack of strategic and rational support contributed significantly towards unsuccessful adoption and implementation of the use of geospatial techniques in resources allocation decision making. In this respect, the study concludes that adoption and implementation of geospatial techniques may not be successful if organizations and their management do not play a leading role, which should necessarily involve coordinating, supporting, encouraging, and motivating employees through the processes.

6.3. Recommendations

In connection with the study findings, discussion, and conclusion. The study makes the following specific recommendations related to actions and future research.

The USAID and other donors who support health care projects in Tanzania should make it a contractual obligation that funds recipients should continuously build capacity of their employees on technologies that will allow them maximize cost-effectiveness in resources allocation. GIS is one of these technologies.

The USAID should build systems for tracking implementation of innovations that it recommends for all its implementing partners including the use of GIS and geospatial technologies.

The implementing partner organizations should incorporate GIS and geospatial skills in their employees' development curricular. Equally, the use of GIS knowledge should be identified as a strategic option for maximizing cost-effectiveness in managing resources. In addition, performance management for individual employees should include development of geospatial techniques as a performance measure.

To achieve sustainability in the use of geospatial techniques, there is a need for implementing partner organizations to recognize their trained GIS champions, encourage them, and use them to build capacity of the other employees. This will serve as a means of motivating them and acknowledging their contribution to successful mentorship of others.

The further study recommends for researches in two different areas. First, there is a need for a research to examine if there is any association between the use of geospatial techniques and cost-effective allocation of financial resources in health care projects. Second, there is a need for a study to examine in detail performance management aspects, which may promote use of geospatial technology in health care projects employees in Tanzania. Finally, it is important to conduct an intervention study that should seek to measure the cost effectiveness GIS technology in different organizations considering the key social economic and demographic characteristics of the organizations.

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APPENDICES

Appendix 1: Consent Form

Introduction

Hello, my name is Yohana Wilfred Mapala I am from Muhimbili University of Health and Allied Sciences (MUHAS). As part of my MPH program, I am conducting a research to assess how use of geospatial analysis can support decision making and resource allocation to USAID Implementing Partners. The results of this study will give inputs to making informed decision and challenges in using geospatial analysis to support informed decision.

You are kindly requested to participate in this study by giving your views and opinions so as to fulfill our goal.. All the information which you are going to give will be confidential and they will be used in nothing more than for the purpose explained above.

Study goals

Assess how use of geospatial analysis can support decision making and resource allocation to USAID Implementing Partners. The results of this study will give inputs to making informed decision and challenges in using geospatial analysis to support informed decision.

Procedure

The study will use two main methods of data collection. These are individual in-depth interviews and Focus Group Discussion. In depth interviews are direct, unstructured formal interviews on basis of one-to-one. This method will include all 30 respondents. The length of each interview shall be 45 to 50 minutes. Focus Group Discussion, Out of the 30 respondents who will be interviewed, 16 respondents will be involved into two FGDs of 70 to 90 minutes each.

Participant selection

The number of respondents expected is 30, these respondents will be selected purposely. The respondent should have received GIS training and working in positions related to resources allocation planning and decision making.

Risk

No any kind if risk is associated as a result of participating in the study.

Benefits

If you agree to participate in this study you will help us know what factors contributing to use of geospatial analysis in planning, resource allocation and decision making.

Confidentiality

Anything you respond will remain confidential and will be used only for research purposes. The researcher will compile a report that will contain information about all other interviewed respondents.

Voluntary consent

Your participation is voluntary. You may decide not to participate in this study without giving any reasons. However your input through participation in this study is highly valued and will be appreciated.

Who to Contact

If you have any questions about this study you are free to contact, the Principal Investigator, Yohana Wilfred Mapala (+255 767664888), Supervisor Dr. Amani Anaeli (+255 713443724)
If you ever have questions about your rights as a participant, you may communicate with the Dean School of Public Health and Social Sciences, Box 65004, Dar es Salaam, or call (+255 2152467 or PROF. ABOUD, M.M. Director; Research and Publication Committee MUHAS; Tel.no. 0713292617.

If you agree to this interview, please sign this consent form.

I …… have read and understood the contents of this consent

Form and my questions have been sufficiently answered. I therefore consent for the interview for this study.

I am sorry; I am not willing to participate [ ]

Signature of the interviewee ……..... Date ……

Signature of the interviewer ……....……. Date ……

Appendix 2: Interview Guide

Introduction

My name is Yohana Mapala, a student from Muhimbili University of Health and Allied Sciences (MUHAS). As part of my MPH program, I am conducting a research to assess how use of geospatial analysis can support planning and decision-making on resource allocation. As part of the study, I selected 30 staff from 15 USAID HIV/AIDS project implementing partners who are engaged in day-to-day planning, decision making, and reporting on how resources should be allocated and provided them with training on how GIS can be used to improve their day-to-day planning and decision making.

At this stage, I am exploring how the implementing partners, especially their staff who were provided with capacity building on the use of geospatial techniques and methods consider them to be useful in terms of improving planning and decision making for effective allocation of resources. The results of this study will be used to contribute on the knowledge on how GIS can be used to make decision making and planning cost effective and thus achieve efficiency and effectiveness in resources allocation. In addition, we need to identify challenges that GIS users have experienced and help them devise means to enhance the use of geospatial analysis to support informed decision-making.

You are kindly requested to participate in this study by sharing your experience and opinions through an interview. The interview will take about 40-50 minutes. All the information which you are going to provide will be treated as confidential, anonymous, and will be used for the specific purpose explained in the consent form that you have signed. Thank you for your cooperation.

PART A: General Information

A1. Interview Date:_____

A2. Venue/Place_____

A3. Name of Organization_____

A4. Title of the Interviewee_____

A5. Interviewee Identification Code _____

PART B: Initiatives to support the adoption of geospatial techniques/methods

Main Question: For more than three years now, your organization has started the use of geospatial methods and techniques in different plans and decisions, which relate to allocation of money and personnel. Now, let us briefly talk about the efforts that have been there to make adoption of geospatial techniques and methods successful.

Probe Questions:

B1. What are the ways used by your organization to make sure that employees who participate in decision making have adequate skills related to geospatial analysis?

B2. What are the arrangements used by your organization to make sure that the software and hardware needed for geo spatial analysis are available?

B3. Generally, how would you talk about the ways in which your organization provide conducive environments for successful use of the geo spatial technology, techniques, and methods?

B4. How can you explain your contribution to your organization in terms of increasing the use of geospatial methods in making important decisions?

PART C: Experiences regarding the usefulness of geospatial techniques/methods

Main Question: As one of the persons who received GIS training in your organization. I would like to learn from you on how geospatial technology, techniques and methods been useful in your responsibilities, which are related to related to planning and making decisions for allocating money and other resources?

Probe Questions:

C1. Let us first discuss the activities that you do as part of your day-to-day job activities?
C2. Which of the job activities involve planning and decision making?
C3. In what ways do you use maps in your day-to-day job functions?
C4. How far have you found maps useful in planning and decision making?
C5. Let us also discuss the information you always show in your reports using maps. What kind of reports and maps?
C6. Related to your job, how would you talk about your preference of maps compared to other presentation methods such as graphs and, bales, and charts? [And why?]

PART D: Challenges associated with the use of geospatial methods

Main Question: Challenges are part of our-day-to day learning. In your organization, what are the main challenges that you have faced in the process of adopting the use of geo-spatial techniques?

Probe Questions:

D1. What can you say about the availability of software required for using geospatial techniques?
D2. In your view, how can you talk about the level of computer skills that you have in relation to computer competencies that GIS needs?
D3. How is technical assistance regarding the use of geospatial technology available in case you face technical problems?
D4. Generally, what would you consider to be the main challenges that affects adoption and use of geospatial methods in your job?

Appendix 3: Focus Group Discussion Guide

A. Introduction

You are all welcome to this Discussion session. I should start by thanking you for responding to my invitation. As I had introduced myself to you during individual interviews, I am Mapala, a student from Muhimbili University of Health and Allied Sciences (MUHAS). As part of my MPH program, I am conducting a research to assess how use of geospatial analysis can support planning and decision-making on resource allocation.

The aim of this discussion is to share some experiences on the adoption of geospatial analysis in our organizations. In addition to the interviews we did with you individually, today we have an opportunity to learn from each other and share experiences on what happened when we started the adoption of geospatial methods and techniques in our organizations, how did other people respond, the progress we have made, how useful we find these technologies, and finally what are the challenges we are experiencing in general.

Feel free to share with us what you have and we assure you that we will use the information you provide generating knowledge only. We do not have something to pay you for participating in this discussion. Your participation is free, but much valued. The researcher will be able to refund your travel cost, ten thousand shillings per each person. Our discussion will take about 60 to 70 minutes only. So, feel free to share with us. Thank you for your valued cooperation.

B. Organization

B1: Establishing ground rules

In our discussion, we will be guided by some simple rules. Let us set them together [should at least include the following]

- Always listen to what the moderator directs us to do
- Respecting and valuing ideas of others
- No wrong answer

- Not to interfere when someone is talking
- Everything we talk here shall be left here
- Do not dominant! Let everybody have chance to talk

B2: Describing Respondents and their roles

- Chairperson (if needed)
- Moderator/Facilitator,
- Recorder/note taker
- Other respondents

C: Discussion Guide Question and hints

C1: The process of adopting the use of geo spatial technology and its related techniques needs building supporting environments in organizations. This includes support from the organization and the employee (user)'s own efforts and initiatives. The first stage was building the capacity through a training which all of us attended. Now, can we learn the experience of each of us on the initiatives and efforts used by our organizations and ourselves to make the adoption successful?

Think of

- Support from the top management (as a strategic change, as part of required competencies).
- Making hardware and software available for all needy users
- Continuous training by the organization
- Special formats that must include GIS information
- Individuals are free and motivated to be innovative and self-initiated
- Individuals self-learning initiatives encouraged and supported
- What specifically do your organizations do to support you use geospatial methods?

C2: The essence of adopting geospatial technology was that when you are trained, you will find it very interesting to use these methods and techniques. That is because, it is thought that the use of geospatial methods make planning and decision making very easy and enjoyable. So, the expectation was that all those who were trained would frequently use maps and

geospatial information as basis for justifying decisions. Now, let us share experience from each of us. How did you find it?

- How did you receive it after training and what did you do?
- How long did it take you to master and use it?
- How have you been able to sustain the use of geospatial techniques?
- How simple or difficult did you find it using geospatial methods?
- What other alternative techniques do you use in place of geospatial techniques?
- In what specific tasks are you required to use geospatial methods in your organization?
- Can you explain to us of the reports that need you to include information on maps?

C3: Challenges are part of the walk to success in our day-to-day organizational life. In the process of adopting the use of geospatial technology and techniques you must have experienced some challenges. So, can each of us share some challenges that he/she has experienced?

Hints (as related to issues including)

- Availability of software and hardware
- Mastery of computer technology
- Support from the organization
- What are the main challenges to you as an individual?
- What have you done as an attempt to address those challenges?
- What should be done to address those challenges?

D: Closing Remarks

- Summarize the main lessons
- Thank respondents and give them opportunity/contact to ask if any concern
- Remind them to leave their differences there
- Assure them of personal security and confidentiality of information
- Remind them on how the results will be used and how they can get feedback

=END=

Post FGD Reminders

Debriefing-on field

Quick notes-expanding notes (at office/home)

Backup field audios records (every evening)

Transcription