ADDRESSES IN GEOINFORMATION INFRASTRUCTURE

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BY

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Dedication

This Research thesis is dedicated to my late beloved Mother who Rest with the Lord on the 22/05/2009 while Iam still pursuing the Msc programme in Netherlands. Mum, Your Spiritual Motivation let me through this journey and May your Soul Rest in Perfect Peace with the Lord

Abstract

The objective of this research is to understand the origin, functions and use of addresses within the public sector and society. To understand the role of address in geo-information infrastructure and base register. To explore the current status of address datasets within the public sector in Tanzania, Place is a unique and special location embedded in space. Space is the boundless, three-dimensional extent in which objects and events occur. The real world can be described only in terms of models that delineate the concepts and procedures needed to translate real-world observations into data that are meaningful in GIS. Data from the primary sources were collected through interviews, questionnaires, and non-participant observations. The interviews were based on structured; unstructured and open-ended questions to enable respondents provide insights on the line of inquiry. Empirical data was collected in the Dares Salam city of Tanzania mainland, and was limited to only Dares Salam because of its geographical location and position as the capital where most of public offices are located. The research targeted the government organizations and also some private organizations that are engaged in creating and sharing address data within the city of Dar es Salam.
The process of interpreting reality by using both a real-world and a data model is called data modeling. Objects in a GIS data model are described in terms of identity type, geometric elements, attributes, relations, and qualities. Data models may be designed to include physical objects, such as roads, water mains, and properties. A conceptual model can be described by using various notations, such as unified modeling language (UML) for object modeling. In this research UML modeling technique was used. In UML notation, the conceptual model is often described with a class diagram in which classes represent concepts, associations represent relationships between concepts. Public sector use addresses for various purposes which include: social service delivery, municipal service delivery, Goods delivery, census, election and emergency services. In research, addresses were classified into seven namely: place name& mental map, semantic address, postal box, spatial-address (coordinates), telephone, emails, internet protocol address (IP).

The concept of base registers, such as census data, cadastres, legal entities, vehicles, addresses, topographical databases, is that they are guaranteed by the government regarding the availability, access, continuity, up-to-datedness, quality, and price to the society. The researcher visited some government agencies during the fieldwork and observed how addresses are use for official registration procedures within the public sector.

The major limitation of the research is the absent of any private sector involved in the development, creation and maintenance of address datasets in Tanzania. Semantic address in the Western Europe is an outdated concept because ‘Address’ by definition is means to find a person at a certain place, but basically we are looking for the person and not the place.

Acknowledgements

To God be the glory, great things He has done. The completion of my Master of Science programme makes the word of almighty God true in my life that '*I can do all things through Christ who strengthens me'*-Philippians 4:13

The journey of this Research work was an interesting and exciting one, but without the support of my family, mentors and my colleagues, it would have not been possible. Therefore I would like to express my sincere appreciation and gratitude to all those who contributed in one way or the other to make the journey a success.

I wish to express my gratitude and thanks to the Netherlands Government for the Fellowship granted to me for the Master of Science in Geo-information Science and Earth Observation programme. And also my employer Federal Capital Territory Administration (FCTA) Abuja, Nigeria for approving my study leaves with pay for the Msc Programme in the Netherlands.

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Words cannot express my appreciation and love that I extend specially to my wife, children, relations and, all my well wishers for their loving caring and with their regular communications, concern and bearing the pain of my absent. Finally I thank all my classmates and all the Msc set of 2008-2010.

I wish say that '*even thought we have departed from ITC/UT, we shall meet again somewhere, somehow if life sustains us'*.

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List of Acronyms

ZIP	Zone Improvement Plan
GIS	Geographic Information System
GEO-ICT	Geo-Information &Communication Technology
DSM	Department of Surveying &Mapping
LD	Land Department
NBS	National Bureaus of Statistics
TPF	Tanzanian Police Force
NHC	National Housing Corporation
DAWASCO	Dar es Salam Water &Sewage Company
TCRA	Tanzania Communication Regulatory Authority
TANESCO	Tanzania Electricity Supply Corporation
TRA	Tanzania Revenue Authority
BRELA	Business Registration& liaising Agency
ICT	Information & Communication Technology
UML	Unified Modelling Language
PO BOX	Postal Office Box
WYSIWYA	Where You See Is Where You Are
GPS	Global Positioning System
GSM	Global Service Mobile
WLAN	Wireless Local Area Network
GRP	Global Routing Protocol
ISP	Internet Service Provider
LAN	Local Area Network
IP	Internet Protocol
GGP	Gateway Protocol
ICMP	Internet Control Message Protocol
SDI	Spatial Data Infrastructure
DBMS	Database Management System
BRA	Base Register of Addresses
BGR	Base Register of Buildings
BBR	Building and Dwelling Register
LBS	Location Based Services
UPS	Universal Parcel System
LBS	Location Based service

1. INTRODUCTION

Address in the dictionary is defines as 'to direct' (spoken or written message) to the attention of people. It is a description of the location of a person or organization, as written or printed on mail as directions for delivery. Other definitions include: Address is a name or number used in information storage or retrieval that is assigned to a specific memory location. Addresses are interesting objects, dealing with people and at the same time with location, therefore address is a societal object and a spatial object. For most people nowadays an address is written as: person name, street name, house number, municipality name, country name. In other words, addresses are used every day by citizens, businesses and government as human understandable description of the location of specific information (person in space). These 2 aspects (societal& spatial objects) will be elaborated in this research.

1.1. Background

Geospatial data provides information about the location and attributes of features that are on, above or beneath the earth surface. It is data can be mapped. The terms land information, geographic information, spatial data geo-information and geospatial data are used to describe spatial data (Groot and McLaughlin 2000). In most government activities and business are related with the geography of people, places, things and events. Implying that the important part of the information needed for planning and decision making is geographic in nature.

Geospatial information (GI) is vital to economic planning and national development as well as the development of various sector of the economy such as census, defense, transport, and land use planning. This is demonstrated by the high demand for GI to address efficient, effective and decision making processes in the these sector has led to the increase of GI (Nyemera 2008). The location of all these sectors require address dataset, hence Addresses are important and very much used in society, to find places, to find persons, to deliver goods and messages (information). Address always has a spatial component and a societal component (Billen and Zlatanova 2003).

In the spatial environment, geosciences, a spatial reference system is used to identify locations on the surface of the earth and an address can be described as "location" in a spatial reference system and given as a set of coordinates. (X, Y) and is numeric. Lind (2000) point out that address is of great importance in the field of geographic information (GI) and the availability of address data of good quality is often the key element in the world of geo-information infrastructure. In social sciences and daily life an address is mostly a character string, in combination with numbers describing a place. Address data is in many countries seen as a natural part of society's core data, on which a more complex spatial infrastructure can be built (AC and Yomralioglu 2009).

In the message delivery environment, other addresses have been developed such as postal codes and zip codes and land line telephones(Hurley, Saunders et al. 2003). With modern technology new addresses have also been developed and are in use such as email addresses and mobile phones.

The Public sector has always been a creator and important user of addresses. Many government agencies have established their own address datasets. With the coming of Information& Communication Technology(ICT) in the public sector there has been a pressure to bring the redundancy in address data out and even standardize (normalize) addresses so that they would become a core data set in public sector information infrastructures. A well- formed, public address system contributes to the physical infrastructure of a modern society. Proper address data can likewise contribute to the information infrastructure (Nedovic-Budic, Pinto et al. 2008). All locations where people live, work, educate themselves need address.

In western European countries, the concept of base register and even authentic register is encountered and addresses are part of such base registers. Development of address base registers in countries as Denmark, Netherlands and Finland is still going on. Zhuang Zhangs(2004) attested that the accessibility of reliable address data can equally contribute to the development of information infrastructure. Cooperb(2006)further point out that the address systems' street names and house numbers enables individuals, postal and transport services, emergency services, police, utility companies and government agencies etc. to find their ways efficiently without use of coordinates.

1.2. The Study Area

The study area is Dar es Salam of the United Republic of Tanzania in central East Africa and is bordered by Kenya and Uganda to the north, Rwanda, Burundi and the Democratic Republic of the Congo to the west, Zambia, Malawi and Mozambique to the south(Lusugga Kironde 2006). Between independence and 1996 the major coastal city of Dar es Salaam had been the country's political capital.

Today Dar es Salaam remains the principal commercial city of Tanzania and the de-facto seat of most government institutions. It is the major seaport for the country and its landlocked neighbors (Kalande and Ondulo 2006). Dar es Salaam Region is one of Tanzania's 26 administrative regions. Dar es Salaam is the regional capital and wealthiest region in Tanzania.

Dar es Salam is the most densely populated with 1,786 people per square kilometers with population of 2,487, 288 according to the 2002 national census. The region also has the second highest population growth rate of 4.3%, after Kigoma region 93.9% of the total regions population people in the Dar es Salaam Metropolitan area. Dar es Salaam is divided into three administrative districts: Kinondoni, Ilala, and Temeke (Kaaya 2004).

1.3. Research Problem

The developmental of base registers and address as a part of geo-information infrastructure lacks a conceptual frame which makes the role of addresses not clear in society and the public sector in particular. With technological developments all sort of new addresses have come into use. It will investigate the importance of addresses in the public sector and how this relates to the modern developments. This study will explore the origins and development of addresses as spatial and societal object. The study will try to classify all the different sort of addresses that can be found in our present day societies. The study will develop and use a conceptual frame to locate addresses in the set of base registers.

1.3.1. Research Objectives

The main objective of this research is to understand the origin, functions and uses of addresses within society and the public sector in particular and sub-objectives include:

- To understand the role of addresses in geo information infrastructure and base registers
- To develop a conceptual frame for address as social- spatial object
- To explore the current status of address datasets within public sector in Tanzania
- To classify addresses in order to understand the use of addresses in modern society

1.3.2. Research Questions

- What are the origins of addresses in the history of mankind?
- How does the public sector create and use addresses in their different operations?
- How are addresses handled in geo information infrastructure and base registers in western European countries?
- What is the current status of address datasets within public sector in Tanzania?
- How does the situation in Tanzania compare with western European developments in address data management?
- Can the different types of addresses be classified within the modern societies?

1.4. Justification

Land administration and land registration are closely linked to the topic of spatial identification and man- land relationship. An address is person and spatial identifier. The concept of addresses is therefore a Land Administration topic and deserves to be elaborated from a geo science perspective. Addresses have for a long time being ignored as geo spatial object in the Geographic Information System (GIS) literature.

Furthermore, there are some countries where address has been developed as a base register of the public sector: for example, Australia and New Zealand (Hockaday 2008), Denmark, (Andersen and Architect 2008), France (Crew and Kleindorfer 2006),South Africa(Coetzee and Cooper 2007), the United Kingdom, the United States of America (Yurman, Griffiths et al.). European INSPIRE recognizes the importance of address as reference data to provide an unambiguous location for user's information need; that enable the merging of data from various sources (Vandenbroucke, Janssen et al. 2008).

1.5. Conceptual framework

The conceptual framework for this research focuses on the origin of address. It describes and analyzed the address as perceived within the society (person and space) in order to understand how addresses came to be.

1.6. Methodology

The following methods were used for the research

- Literature study on origins and development of addresses as a public sector data and base registers.
- Use of modelling techniques to develop a conceptual frame for address as social -spatial object.
- Literature review on the development of base register in Europe.

- Fieldwork in a developing nation to assess the importance and use of addresses, especially in the public sector (Tanzania).
- Critical comparison of developments in Europe with those in a developing nation (Tanzania).

Data from the primary sources were collected through interviews, questionnaires, and non-participant observations. The interviews were based on structured, unstructured and open-ended questions to enable respondents provide insights on the line of inquiry (Yin 2002).Empirical data was collected in the Dares Salam city of Tanzania mainland, and was limited to only Dares Salam because of its geographical location and position as the capital where most of public offices are located. The research targeted the government organizations and also some private organizations that are engaged in developing and sharing address data within the city of Dar es Salam.

Organizations visited during the field work included: Ministry of land, Human Settlement and Development, Survey and Mapping Department, National Housing Corporation, Tanzania Electricity Supply Company, Business Registration and Licensing Agency, Tanzania Fire Service, Municipalities, Tanzania Post Corporation, National Bureaus of Statistics, Dares Salam Water and Sewage Corporation. Within these organizations the lists of persons in appendix 18 were interviewed because they are directly involved in geo-information activities of their organizations and are knowledgeable in the functions of addresses within the public sector.

1.6.1. Literature Review

The literature review aided in the building of conceptual framework relevant to this research. Context and history of addresses, concept of address, address in the public sector, fieldwork analysis methodologies, concept of base registers, geo-information infrastructure etc.

1.6.2. Secondary data

Source of secondary data are background information in form of reports, legislation and evidences that can be used to substantiate conclusions to make them as objective as possible. Literature reviews was done to understand the current situation of address datasets as a base register of the public sector.
Secondary data involved reviewing publication and existing documents with information regarding the research topic. Secondary data help the researcher to know the concept of base registers and the use of addresses in the public sector. Secondary data was specifically obtained through internet search. Secondary data collected are listed below

- Bibliographic and historical compilation of National documents and documentary study on key stakeholders / custodians of fundamental datasets.
- Documentary study on implementation procedure for policies, prescriptions, decrees, initiatives and compilation of literature about different organizations in address data sharing of the public administrations. Review of documents on Organizational goals and strategies

1.6.3. Primary data

- Questionnaires

The questionnaire allowed data collection from few people in the short time; data collection was by structure questionnaire delivered to the respondents by office visit and was structured open ended and unstructured questionnaires were prepared

- Observations

The fieldwork was executed in two phases: field observation assed the status of address within the city of Dares Salam. Secondly the researcher visited some organizations within the public sector and had interviewed with some key government officials.

- Photographs

Camera was used to captured picture of bill boards, street name and housing numbering format

- Fieldwork

Interviews, questionnaires methods were applied to the users of address data to know which kind of datasets they have. How they handle address data. To understand the procedures of creating address data within the public sector.

1.7. Thesis Structure:

CHAPTER ONE: INTRODUCTION

This chapter introduces the topic of the research; it describes the research objectives, questions, and the research framework and key references to prior work done, describes the relevant concepts, it provides a critical review of experts' opinions on address data infrastructure.

CHAPTER TWO: DEVELOPMENT OF ADDRESSES

This is the chapter where relevant literature were reviewed on the origins of addresses, , concepts of space and place, transport and message delivery, concept of base register, economic development, are treated. Finally it will provide an overview structure of the thesis.

CHAPTER THREE: ADDRESSES IN THE PUBLIC SECTOR

This chapter looked at the uses of address within the public sector, develop a conceptual frame as spatial and society where address is the linking object, concept of base register, use of ICT are discussed.

CHAPTER FOUR: METHODOLOGY/ FIELDWORK

This chapter contain the methodological approach to carry out the fieldwork on the study. The methods as well as the process of data collection for the study are discussed. Completeness and validation of the field return was also discussed

CHAPTER FIVE: DISCUSSION AND CONCLUSION

This chapter contain the discussions on the western European concept of base registers and how it relates Tanzania case. Social benefits of addresses as public sector information infrastructure Conclusion on the research is drawn

CHAPTER SIX: LIMITATIONS, RECOMMENDATIONS,

This chapter present the limitations, recommendations for further research.

2. DEVELOPMENT OF ADDRESSES

2.1. Introduction

There is a lot of literature which studied the concept of space and the relationships of people in space. This concept of space is still every much existing in our society and also in the geo-world(Harvey 1993). People are living certain bounded area and the place has a name which is considered as the first level of addresses. Kwan Janelle et al(2003) point out that the analysis of space and place has become an increasingly important component of social science research in recent time . Place, like Space lies at the core of geographical and philosophical literature (Pacione 2005). In this research the concept of space is elaborated in detail.

2.1.1. Space

The dictionary defines Space as the boundless, three-dimensional extent in which objects and events occur which have relative position and direction. Madanipour (1996) noted that space is a key concept for all dealing with both social science and geosciences. Here the researcher looked at how the geosciences conceive the concept of space.

2.1.2. Space in geo sciences

In geo sciences, the concept of space can be understood by the role of Geographic information system.(GIS) is playing an important role in the face of the rapid growth of digital spatial data in the geosciences(Bonham-Carter 1994).Many spatial datasets are now being generated by government agencies for their use as a result of the development of GIS tools. Elmes et al (2005) further point out that GIS has made a tremendous input in many field of applications because it allow the manipulation and analysis of single 'layer' of spatial data and also provides tools for analyzing and modeling the relationship between layers. Geospatial data provides a powerful decision support and finds optimal solutions in geo-application domain (Groot and McLaughlin 2000). Geo-information has economic, social, and policy value (Craglia, Annoni et al. 2007).

Spatial Data Infrastructure refers to the technologies, standards, arrangement and policies that are required to collate spatial data from various local databases to facilitate integration at different administrative levels(Bernard and Craglia 2005).spatial data is elaborated

2.1.3. Spatial data

Spatial data is data that describes the attributes of some object or thing occurring at one or more locations in a geographic space (Rajabifard 2005). The object could be a building, water reticulation network, mangrove forest; Data is normally managed as part of some theme: built environment, utility infrastructure, vegetation, population dynamics, demography and many others (Onsrud 2004).

Spatial data is made by connecting data about a theme with a spatial model of its geographic distribution. For example, the simplest method is to connect the latitude/longitude coordinates of the location with each observation in a dataset. Spatial data at geographic scales have been most commonly represented in the form of maps (Mlittar 2008). Simple spatial objects in graphical

representations are point, line, polygon and polyhedron. It is important when talking of space; outer space is also important to mention because outer space forms an important resource for human beings and for the future.

2.1.4. Outer space – remote sensing

Dictionary defines Outer space as the void that exists beyond any celestial body including the Earth. It is not completely empty but contains a low density of particles, predominantly hydrogen plasma, as well as electromagnetic radiation. Outer space is the common wealth of humankind, which should serve people around the world. It is hard to imagine a modern society without the support of outer space assets. The development and progress made in the fields of economy, culture, science and military of every country is related to the use of outer space. Outer space is an important resource for human beings at present and in the future.

The production of Space, the national territory as physical space is mapped, transformed by the networks and flows that are established within it such as roads, canals, railways, commercial and financial circuits. Thus this space is a material-natural space in which the actions of human generation take place. The production of social space such as an artificial edifice of hierarchically ordered institutions, of laws and conventions upheld by 'values' that are communicated through the national language(Lefebvre 1978).In space we have place, but space and place always confused. In the next section place is elaborated.

2.1.5. Place

Place is a unique and special location embedded in space (Blatter 2004). Place is a bounded area and its people (Blatter 2004). It is not to be understood just as a physical location, but also to be recognized with its social, psychological and dynamic (time) aspects (Cresswell 1996). Place as location for human activities is basic for the sense of identity as well as sense of community. Place can be a central concept in analysis of how urban areas are constructed. Cities are urban places where social relations occur. Individuals, households, communities, companies and public agencies with their social, economic and political relations, exist and operate in particular places (GA Elmes, EF Epstein et al. 2005).

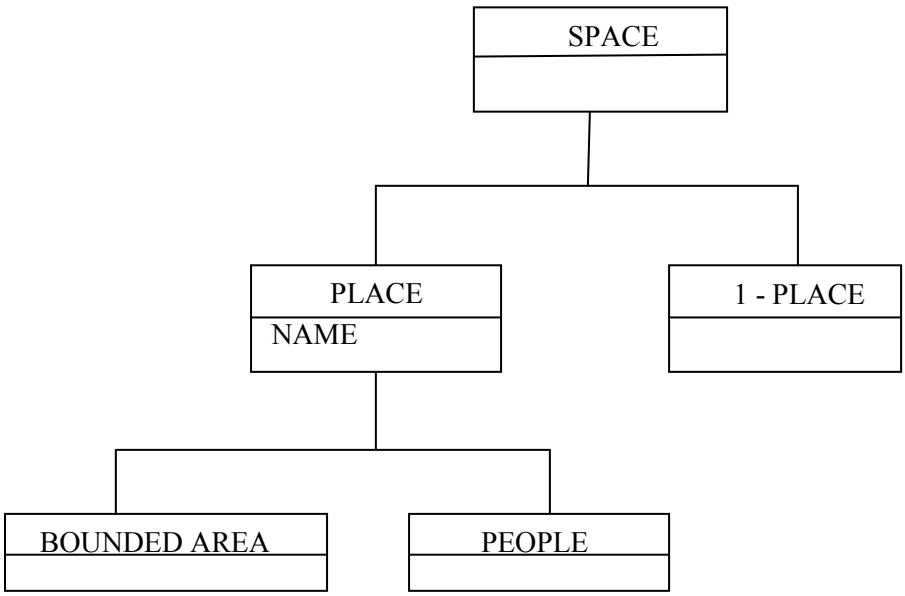
2.2. Conceptual model of space

A conceptual model represents 'concepts' (entities) and relationships between the entities (Böhringer and Löschel 2006). A conceptual model can be described by using various notations, such as unified modelling language (UML) for object modelling (Tuladhar 2002). A UML class diagram describes the types of objects and the various kinds of structural relationships that exist among them like associations and subclass. Furthermore the UML Class diagrams show the attributes and operations of a class and the constraints that apply to the way objects are connected(van Oosterom, Lemmen et al. 2006).The proposed UML class diagram for the space contains object classes like place, non-place. In this research some UML class diagrams will be used.

Space can be perceived as the highest level class. Space can then be decomposed. Place is defined as the combination of people in bounded area and often gets a name (Cresswell 1996). Place is a component of Space (part - of relationship). If there is more space than the sum of places, then theoretically there is also "non-place" as a part of space. (1 – Place) In other words: Space is the aggregate of place and non- place.

In literature the concept "non place" can also be found. Non places are marked by a lack of attachment, by constant circulation, communication, and consumption that act against developing social bonds and bonds between people and the world (Graham and Healey 1999). In contrast to traditional places, where orientation and belonging are based on sedentary and localized inhabitation, non-places are designed to be experienced by transitory and mobile shoppers, nomads, tourists, itinerants, migrants, and virtual workers (Blatter 2004).

In our (UML) model we will not elaborate on the non place item. We just presume that with the introduction of "non place" that not all space (land) is covered by place. In figure 2.1 place is decomposed into bounded area and people. People give a name to the bounded area. The name often refers to what can be observed in the area (Where You See Is Where You Are) (Lefebvre 1978).The name is an attribute of the land object (area).



2.1: Model of Space

The attribute 'Name' of a place is a first address in society. In topographic mapping map names are essential elements (toponame). Generally they are even gazetted to become the "official" place name that is recognised by a State. People in bounded area made up a society

A society is a body of individuals that are bounded by functional interdependence, possibly comprising characteristics such as national or cultural identity, social solidarity, language or hierarchical organization (Virginia, Wilson et al. 2006). People in the bounded area make up a society. Very old societies were nomadic but once the society becomes sedentary, engaging in farming and beginning to develop economically. The physical characteristics of the place becomes more diverse

and complex giving rise to an urban area is a complex spatial object (Harvey 1993).the name of pace is first level of address.

2.2.1. Place-name & Mental Map

This is the first level of address that has been in use because it is the oldest, most logical and historical which is related to the concept of place. Place-name is very important because it has identity that often tells something about the people (WYSIWYN) as described by social geography. In some situations, recognizing locations or places from descriptions depends on some knowledge on the part of the recipient(Coetzee and Cooper 2007). Place indications are composed of a place name with some complementary information, such as distance or direction. Semantic is a place name address and a typical hierarchical type of address with identifier of country, state, municipal, street, house number, and apartment. It is man to land relationship which is a combination of character and number E.g. 99 Hengelosestreet Enschede this kind of address is predominantly used within the society.

2.2.2. Semantic address:

This is man –land relationship common known as geographic identifier reference system comprises a related set of locations types that may be related to each other through an aggregation and possibly forming a hierarchy. An example of a geographic identifier reference system is country, state, municipality street name house number and possibly apartment number. Semantic address is developing as a result of economic development within space through various specializations.

2.3. Economic development and Space

2.3.1. Economic development:

A main characteristics of economic development is the progress towards an increasingly intricate pattern of labour specialization (Woolcock 1998).As the world is changing, Economic worldwide are undergoing process of profound and continuing structural change driven by information and communication technologies. Information and communication technologies are transforming the business of government by improving the ability to collect maintain access share and use GI in digital environment.

Most human activity depends on GI on knowing where things are and understanding how they relate to each other.GI is part of our daily lives used to make decision on economic and social In communities at the earliest stages of development, practically all goods and services are produced and consumed within the family group (Boserup, Kanji et al. 2007). The greater effort expended in agricultural systems made the shift to sedentary communities impractical to move in search of better and for this, each farmer use his name to identify the farmland or farmhouse and also lead to his Village. The development of sedentary settlements accelerated the rate of technological development (Blatter 2004). All the combination of road name and village name gives an address of the farmer who can easily be located or reach.

In Villages, there are important features for communication systems are Central Square, the tree for announcements and message delivery point. The villagers depends on oral communication in most cases for information or the Person is accessed (for messages) through central point. Another feature

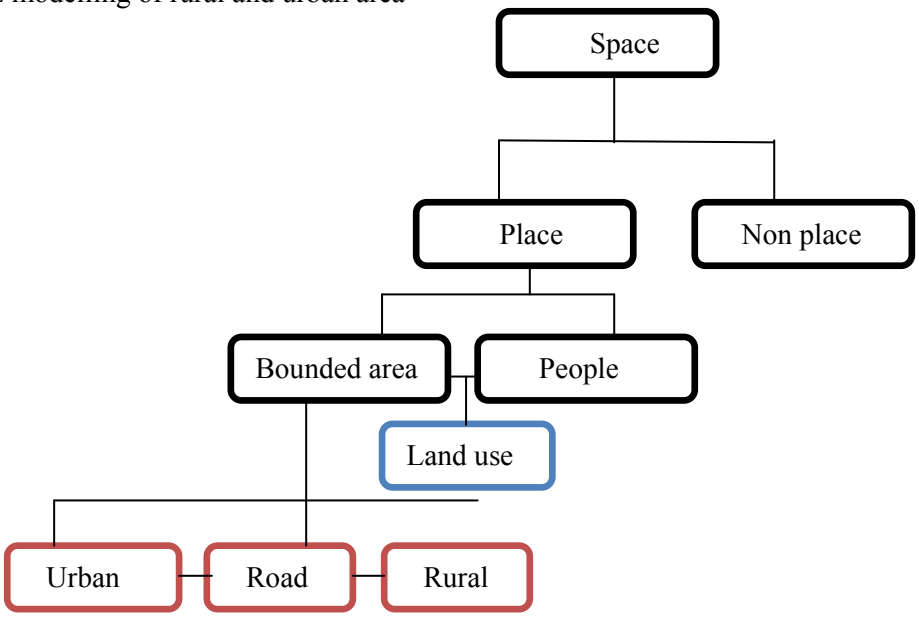
of villages is that people marry, give birth, and die among those with whom they share daily life experiences. Normally there is somebody who is appointed by the village council to make such important announcement at the central square or under the tree mostly at the centre for all villagers. When sedentary communities begin to develop economically, the development of sedentary settlements accelerated the pace of technological development. Villages and cultivated fields became the dominant features of human society and this give rise to urban development which require address.

2.3.2. Urban and Physical development

The development of an urban area with buildings is highly dependent on the quality of the public space which serves the plots. These plots and streets together make up a neighbourhood that has a name. When the neighbourhood expands or develop into blocks and streets which later become city with a name. Physical expansion of the cities is a dynamic process which changes the physical space of the city in a vertical or horizontal direction. The objects that is responsible for urban and physical development of relevant in geospatial sciences. In geo information science data are classified as spatial and non spatial both imprinted with a temporal sign (Pfeffer, Baud et al. 2006) .Non spatial or attribute data are linked to their spatial object by means of objects identifiers. Since a large proportion of address data are referenced by location,

GIS have been used in the address data infrastructure extensively. From GIS perspective, spatial data in urban development can be grouped as points, lines, and areas. Objects of interest in a GIS are spatial objects ,i.e. objects that have thematic and geometric characteristics(Jones, Alani et al. 2001). Consequently we talk about 3D GIS when the objects are geometrically represented in three dimensions. The common understanding is that the most important 3D real objects in urban areas are buildings and terrain objects (Billen and Zlatanova 2003) . The 3D topographic objects are basically the 3D spatial objects currently maintained in a variety of Information systems. The combination of city name, neighbourhoods' name, streets name building number with the access point to the streets made address. In the urban cities, address is usually person name, street name house number, and city name .This type of address is person tie to specific location. Figure 2.2 is the UML modelling of the rural and urban development

UML modelling of rural and urban area



2.2 roads linking rural/urban

Figure 2.2 above is extension of the figure 2.1 that was developed from the expansion of bounded area where places and cities develop into urban and rural.

2.3.3. Spatial-address (coordinates)

With the development in the geosciences and the field of measurement, land surveying has become very important by making land a valuable asset. Land surveying provide useful information that is relevant to the registration of land title and so many other things. This information for the registration is in form of coordinates from the maps for the register of the cadastre (map-register-cadastre).The science of land surveying also gives coordinates to objects in space which makes them relevant. Objects in space now have coordinates address in form of (x, y, z) which are completely numeric and are mostly use by the land surveyors for their works.

These coordinates are not easy to interpret or remember accept by the land surveyors. In topographic mapping, land surveying have create coordinates address to every object on the earth surface and When the topo-name on the topographic map is combined with the name layer, then it becomes meaningful to people who may wish to read or use the map. This is kind of address is not commonly use by the society, it is mostly use by geosciences

But with the rapid advances in positioning technologies such as GPS, GSM, and wireless local area networks (WLAN) this new development has improved the communication capabilities and location-awareness known as location based services(Liu 2009).Location-Based Services (LBSs) has two main functions such as Public disclosure of location information and to enables many useful location based information services. new business opportunities, and a wide array of new quality of life enhancing services has also emerged (Shupeng 2000). The ability to locate users and mobile objects accurately also opens door to new threats intrusion of location privacy (Leshed, Velden et al. 2008).In this

research the coordinates is consider as the third level of address i.e. plot –oriented, the coordinates largely used by the land surveyors and navigators (Maanoja, Kokkonen et al. 2004). With this new technology, Spatial-address is developing toward person –oriented. Google Earth being private sector has added valve to the semantic address with coordinates becoming a combination of semantics and spatial-address(Smith, Mackaness et al. 2004).

2.4. Transport and Messages

Transport is an important means of communication whether in form of physical transport flow or in information flows. In transporting physical goods or delivery messages from one place to another, it all requires address. The production of specialization allowed social separation which brings economic specialization to the society. Economic specialization led to social stratification and Trade in a variety of goods worldwide. Transport is inherent part of development of the people and when urban area begins to develop then it tends to separate into residential, commercial and industrial areas. People move with their goods from one location to another or to deliver message over roads and streets which is the gateways. Therefore to transport goods or to deliver message need an address.

2.4.1. Transport

In the past the only way you could deliver message or transport goods to another place is through the, Traditional transport system which has always carries the traditional semantic addresses. Sometimes it is combined with the local knowledge of the person using mental map. For example, Relative addresses usually take the form of an absolute reference attached to an indication of relative positioning, such as “10 km to the North of Enschede” or “close to the ITC Hotel”.

The indication of relative positioning is usually formed by an expression that denotes a spatial relationship (e.g., near, close to, beside land mark from, and so on) and an absolute address (Peake and Moore 2004) and also taxi drivers are most users of mental map, they can take you to the place you may wish to go without using any map. They will only use some land marks within the location because technology for coordinate addresses was not available at that time. That is why society has always and still relied so much on semantic addresses, mental maps, hardcopy maps (transport maps – tourists maps-landmarks – no coordinates).Building (and addresses of buildings as an attribute of the building) also were often known as coordinates.

Land surveying attach coordinates to the parcel and building but address is detach from it. The coordinates of the buildings are present as geographic coordinates. The house-exact geo data are used in many mobile navigation systems. They can be determined by building-inspection and partially by interpolation of exact street-sections and residential district coordinates. The coordinates are not based on information of the land registry offices or the land surveying authorities. The accuracy refers to individual buildings or building complexes. Development of address coordinates is quite recent.

2.4.2. Messages

Information has becomes a resource in developed economies and there are different ways of sending messages. There is analogue and electronic and under analogue we have postal code and postal office box

2.4.3. Analogue- paper massages postal delivery.

The postal delivery which was developed as alternatives to the semantic address, it is of two types namely post code and postal box. Postal code address is a comprehensive list of addresses at which mail may be delivered. It is created and maintained by the post office and is organized into post codes for the purpose of handling and sorting mails. The list is hierarchically organized on a geographic base and this format is reflection of the postcodes. For example the postcode for Netherlands is 6 alphanumeric characters(1234AB), 4 digits and 2 letters, with a space between the digits and the letters to the left of the locality name(Van Ham and Clark 2009) and also Nigeria postcode is 6 digits(930283) to the right of the locality name (Tayo 2007). Post code was developed as a result of the complex nature and deficiency in the semantic addresses as the urban areas were developing economically which is very difficult for the postal office to deliver message to the recipient as required.

PO Box address is a uniquely-addressable lockable box located on the premises of a post office station. It is numeric and located at the centre of city for easy access by the society. The quantity of post office boxes in a station varies widely(Hurley, Saunders et al. 2003).Stations of small areas are often equipped with fewer than 100 boxes, while stations in a central business area may offer a combined quantity of over 100,000 post office boxes(Lind 2003). Numbering of the boxes are normally done from the top to bottom, for example, from the point of view of the postal worker on the inside, so that the boxes are numbered right to left from the point of view of the box-holder(Birch 1979).

Other countries use numbering systems different from that just described. Post office boxes are usually mounted in a wall of the post office, either an external wall or a wall in a lobby, so that staff on the inside may deposit mail in a box, while a key holder on the outside of the building may open his or her box to empty the mail (Biggart 1977). Postal or urban addresses are the most common resource city dwellers use to convey geographic locations. Addresses are usually the most common reference to events and phenomena that take place in urban areas(Davis and Fonseca 2007).In postal addresses, the sender cannot assume the existence of such a environment or of common knowledge between himself and the postal workers that will route and deliver the package.

Postal addresses are the most structured form of addressing people use. Postal addresses are used for a variety of purposes in many different applications of which land administration is one. From a land administration perspective it is possible that the address can be used to link data from a variety of sources. For example, the references used in the land register, in the cadastre, other government agencies and the municipalities / local government authorities should be compatible(van Oosterom, Groothedde et al. 2009). Although postal codes are usually assigned to geographical areas, special codes are sometimes assigned to individual addresses or to institutions that receive large volumes of mail such as government agencies and large commercial companies.

2.5. Electronic message delivery

2.5.1. Telephone: land line

This means of message delivery can be telephone which is land line base and mobile phone
Telephone telegraph are land line base. Telephone number on the landline has a fixed location usually with telephone book that has the name and semantic address of the subscriber for identification. Telephone calls are a kind of spatial interaction and are dearly related to other types of spatial interaction, such as commuting, social visits, tourism, trade, migration (Waverman 2001). The telephone helped in the development of larger metropolitan systems with a more diversified and complex structure it is also a central element in the work organization and communication (Buhrmann and Leuca 2000).

Telephone: Mobile phone
Mobile communication has become very common and it is now a part of our daily lives. People use their mobile phones every day, making voice calls and sending short messages to each other. Some of us even play games or browse the web using mobile phones. More and more mobile services are launched and advertised in addition to the widely used voice calls and short messaging services because of their importance. New innovative services are launched frequently, covering all areas from entertainment to business services. The evolution of mobile services does not seem to stop here, as many new ways of using mobile phones are constantly emerging. (Person not location)

2.5.2. E mail Address

The Internet is the latest addition to the communication infrastructure that has been developed over the centuries (Bhagwat and Perkins 1993). This virtual person oriented address and the most recent innovation in the address development which has no geographical boundary. You can send messages to your love ones and business partners in any part of the world without you seeing or talking to your recipient. The Internet consists of a large number of individually administrated networks called autonomous systems. The global routing protocol, (GRP) is a path vector protocol that propagates routing available information among all the independent systems(Chen 2003).The route selection decisions are primarily driven by routing policies which reflect the Internet service providers (ISPs) (Grönlund and Grönlund 2002). In today's routing system, a router has information regarding the physical location of the destination or the distances of the alternative routes (Bhagwat and Perkins 1993). Virtual address – person

2.5.3. Internet Protocol Address

IP Address (Internet Protocol Address) is a unique string of numbers that identifies a computer or a server on a network(Van Deursen and Pieterson 2006). When you connect to the Internet, either via your Internet service provider (ISP) or your office LAN connection, you are assigned an IP Address

(Waverman 2001). This address identifies your computer from the other computers. An IP Address can be private, for use on a LAN, or public, for use on the Internet or other WAN. Your IP Address can be either static, meaning it never changes, or dynamic, meaning each time you dial-in or login you are assigned a new address for that session (Postel 1981).

Computers use IP addresses to locate and talk to each other on the internet, much the same way people use phone number to talk to another on the telephone. In layman terms it is the same as your home address. In order for you to receive mail at home the sending agent must have your correct mailing address (IP address) in your town (network) or you do not receive mails, or deliver the mail to recipient. The same is true for all equipment on the internet. Without this specific address, information cannot be received(Anderson 2007).

IP Addresses are usually expressed as four decimal numbers, each ranging from 0 to 255, separated by periods(Van Deursen and Pieterson 2006). For example, 127.0.0.1 and it is much easier for you to remember a web address name such as fitkab@yahoo.com than it is to remember 192.168.1.1. IP address utility includes the IP address, host name, city, state, region/state, postal/ZIPS code, country name. Country time zone, latitude, longitude, ISP domain Name net speed and IP decimal(Van Deursen and Pieterson 2006).

The network connecting devices are called Gateways. These gateways communicate between themselves for control purposes via a Gateway to Gateway Protocol (GGP) (Bhagwat and Perkins 1993). At best, you'll get the exact city in which the user of the IP is located (Postel 1981). For an exact physical address you would need to contact the ISP (Internet Service Provider) of the IP address in question. However, without a police warrant, or some sort of legal document forcing the ISP to turn over the information, don't expect them to give you the physical postal address of the user that was assigned the IP at the time you received the offensive email, or other means of offensive / questionable communication from said IP. The best you can do in this case is to file a complaint with the ISP and forward them all of the information from the offensive and questionable communication regarding the complaint.

2.5.4. Concluding Remark:

This chapter has given the general view of addresses in the history of mankind. Conceptual model of the history of address was developed. The chapter concluded with the classification of address into seven different types as found during the research.

Classification of addresses

1. Mental map & Place name: Is first level of address. Place indications are composed of a place name with some complementary information, such as distance or direction.

2. Semantic addresses**:** this is the second level of address. It is more complex when society becomes develop economically, and urban specialization becomes complex. More people in a small area- higher resolution to find a person

3. Spatial address also known as ‘coordinates’ developed by land surveyors. It is not easy to because different to interpret. (Coordinate systems has been invented for long time but not tied to the semantic address.

4. Postal address**:** this is the fourth level of address and very popular in use by the society. It is of two types Postal code which is spatial specific and post box is less spatial and is centralised in the local post office- person specific.

5. Telephone number – land line more spatial than person and the second is Telephone mobile number – person specific, spatial independent

6. E mail address**:** this is one of the latest address that it is use almost all over the world ,it has no geographical boundary and like POBOX but is person specific, spatial virtual and also call cyberspace

7. IP address: spatial specific zooms in via provider service area to the location of a computer
Computers use IP addresses to locate and talk to each other on the internet, much the same way people use phone number to talk to another on the telephone.

3. ADDRESSES IN THE PUBLIC SECTOR

3.1. Introduction

State is a politically organized body of people under a single government (Narang and Reutersward 2006). The territory occupied by one of the constituent administrative districts of a nation. This includes territory, people, laws, institutions(Hood 1983)

3.2. Public administration levels and bodies

As the world is changing Economic worldwide are undergoing process of profound and continuing structural change driven by information and communication technologies. Information and communication technologies are transforming the business of government by improving the ability to collect maintain access share and use GI in digital environment. Most human activity depends on GI on knowing where things are and understanding how they relate to each other.GI is part of our daily lives used to make decision on economic and social. The state is the people of a country with territorial boundary and is organized into various levels such as National, Regional, and Local Government for the purpose of administrative convenience (Mulgan and Albury 2003). For the state to function properly, it need to have some bodies such as ministry of defence, ministry of commerce, ministry of finance & economic affairs, ministry of interior, municipalities, which are part of the public sector.

3.2.1. Public sector

Government organizations act separately for the collection, storage and dissemination of information which could lead to inefficiency intern of time and cost .geo-information technologies can be used by these organizations in the collection and management of GI as support tool for the economics of the public sector

The public sector sometimes referred to as the state sector which is part of the state that deals with the production, delivery and allocation of goods and services for the government or its citizens, whether national, regional or at local/municipal(Virginia, Wilson et al. 2006) and the state needs information on what or who is where (territory, people and property). This information are in registers of different state bodies such as ministry of defense (military) that keep information (spatial-addresses) on topography maps, place names, roads, urban areas, forest and swamps for military operations and security of the state.

Cadastre (land register) keeps information on parcels, ownership and land use in order to improve land market and good land policies for poverty reduction, while ministry of justice have information on persons (civilians) and properties which help in documenting legal transactions in the cadastre and any other thing.

Ministry of interior (civil register) keeps information on person in order to plans well for the society in term of physical infrastructure, social services. The citizens will be able perform to their obligations, for example paying tax, to vote in an election or be voted in election. The ministry of finance &economic affairs (legal persons) keep information on the business organizations in order to know where these organizations are and what they do, which aid the state in tax collection.

Other bodies of the state are the municipalities who are responsible for creating infrastructure like street naming, water ways, cables building numbering and proper land use monitoring .All these

registers mentioned above require address in order to effectively use them. From these registers, the objects that require address in a state include person and properties.

3.2.2. Why public sector

Public sector use addresses for various purposes which includes: social service delivery, municipal service delivery, Goods delivery census, election emergency services and many other.
Social Services Delivery: although an address does not include any demographic information, but it gives a clear indication of density of human activity. These densities can assist national departments for planning and social services such as health clinics, schools and social service payout points in a country.

Municipal Services Delivery: The supply of services such as water and electricity uses spatial address databases during planning. Spatial address databases are used to plan where to deliver the services, to coordinate and maintain the service networks. These services are either delivered by local government or by utility companies. Addresses are very important to bring service to in place or location.

Goods Delivery: Courier, freight and logistics companies use spatial addresses to deliver goods to the requested delivery addresses. Spatial addresses can be used at various stages of the delivery service, starting with address verification when the order is placed. Routing when the delivery schedule is worked out, and ending with the driver using a map to deliver the goods at the requested address.

Census and elections: For the planning and execution of a Census, spatial address databases are used for the delimitation of enumeration areas. Address is required for planning and execution of surveys. And display of Census results. The ministry of interior that keep register on the citizens(civil) Similar to the Census example above, electoral organizations use spatial address databases for the delimitation of voting districts and the identification of voting stations in a country (Proenza 2003).

The cadastre (land register) needs information on the plots and owners from the register that contains identified and delineated public and private parcels. Land administration includes cadastral surveys to identify and subdivide land, land registry systems to support simple land trading, and land information systems to facilitate access to relevant land information, such as land value, land ownership all require address, etc. Although the actual address numbering system differs from country to country. addresses for land identification are usually closely linked to any land administration systems (Akpoyoware 2003).

Emergency Services: Whenever there is any emergency, address of the location require therefore, a spatial address database can be used to locate the emergency point.

3.3. Addresses in the public sector

The objects in these registers need address because without the address, the objects cannot be used by the state find either place or people. Even though the address forms the hub of a public records system, street names and house numbers are still processed in the different registers at moments, the discretion of the officer in charge on specifications and different levels of revision, completeness and reliability of the addresses depend entirely on him. The parcel register has geo-address while person register (natural and legal) keeps semantic address in them .Each state body develops its own data and

therefore has its own address which will result in having many addresses pointing to the same object which cause duplication of addresses.

The role of Local governments is an interesting one because it is the lowest level of government which interacts with the society. Addresses are very important to the administration of local government. Furthermore, the local government creates addresses in the process of urban planning, building permits, roads and public transport. Local governments have many tasks which include: Make use of address in service delivery to school, local health centre, street naming and house numbering. The local government made use of addresses in the environment e.g. refuse collection and waste water treatment, taxation (municipalities tax), and to a large extent they are also in charge of the supply of water, electricity, and natural gas and all these are handled by many departments and duplication of addresses can occur (Aydinoglu and 2004).

3.3.1. ICT in Public Sector

Governments at all level have cooperated with each other on a harmonization and quality of public registers and maps in order to improve the public service delivery. All papers registers will be converted to digital formats, thereby creating a database for these registers, removing redundancy. The registers containing address datasets are believe to be most duplicated(van Oosterom, Lemmen et al. 2006). It is quite clear that Semantic addresses are the most duplicated dataset in many organizations because they are the mostly use and are created by different department where there are no standards in the datasets.

Hofkirchner fuch et al(2007) pointed out that with the introduction of ICT in the public sector, services will create database of most of registers that will be made more 'efficient', where 'efficiency' means increased speed of delivery combined with a reduction in costs. ICTs will remove some of the 'friction 'within public sector bureaucracies which is identified by governments as major cause of citizen conflict.

3.3.2. ICT Push

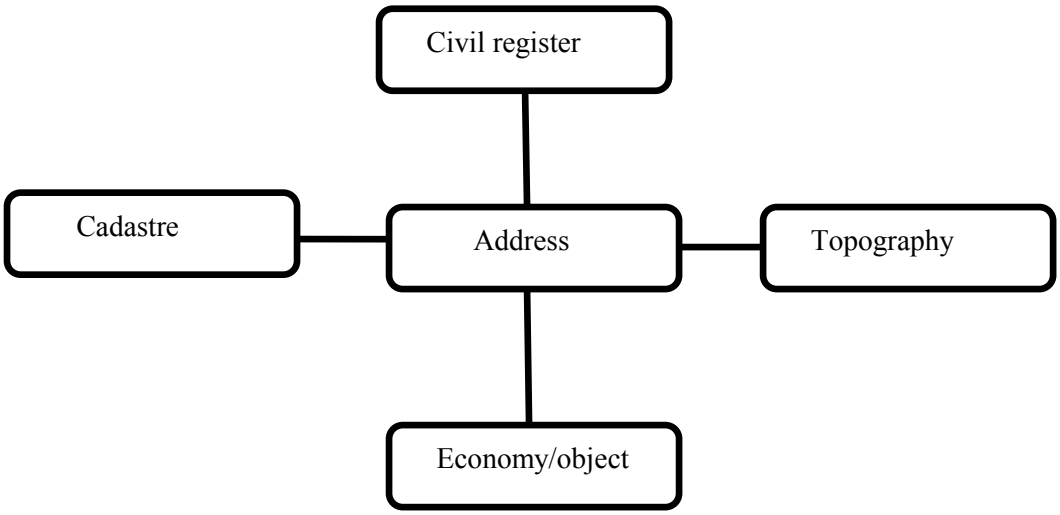
The Information& Communication Technology (ICT) have given tremendous push toward the development of geo-spatial database infrastructure. Both theoretical and practical development in ICT such as the ubiquitous communication (internet) database management systems (DBMS), information system modeling such as unified modeling language (UML) and global positioning systems has improve the quality, cost effectiveness performance and maintainability of databases within the public sector(van Oosterom, Lemmen et al. 2006).

According to the professionals developing the digital database will eliminate redundancy and duplication of efforts within the public sector. These register may not necessarily be a centralized one but could be a connected databases. Spatial Data Infrastructure (SDI) refers to the technologies, standards, arrangements, and policies that are required to collate spatial data from various local databases, and to make this collated database accessible and usable to as wide as possible(Jacoby, Smith et al. 2002). SDI provides the basis for spatial data usage, discovery, and analysis.

In government context, SDIs are established at any level of government: local government, state, or on national government level to enhance government activities (Nedovic-Budic and Pinto 2000). Among others, an SDI typically includes base datasets for cadastre (land parcels), economic /object, civil register, and topography as shown in Figure 3.1below. SDI supports access to geographic information (Nedovic-Budic, Pinto et al. 2008). This is achieved through the coordinated actions of different

departments within private and public organizations that promote awareness and implementation of complimentary policies, common standards and effective mechanisms for the development and availability of interoperable digital geographic data and technologies to support decision- making at different level (Pfeffer, Baud et al. 2006). Here address is an important object that links the spatial objects to social objects in space. It provides a basis for spatial data discovery, evaluation and application for users and providers within all level of government. It is meant to promote the concept of a reliable supporting environment, analogous to a road or telecommunications network that in this facilitates the access to geographically related information using a minimum set of standard practices, protocol and specification (Nasirumbi 2006).

SDIs comprise of the fundamental datasets as well as the interrelationships between these datasets, the management of them, and the means of accessing and distributing these data. One of the most important first steps in the creation of an effective SDI is the establishment of communication channel between the individual and organizations concerned with spatial data (Moens, Broerse et al. 2008).



3.1 address linking space/society

Cadastral data is considered to be the backbone of the spatial data in modern market economies. Together with the base topographic data, they are referred to as 'foundation data' and play a major role in the discussion around the establishment of spatial data infrastructures (Groot and McLaughlin 2000). From the model 3.1 above show a generic model which is use all over the world, which combination of spatial data infrastructure and social data of the public sector. Van der Molen et al(2004) point out that the development of data infrastructures is not only to provide easy access to distributed databases, but also gave good opportunities for re-thinking the role of information supply for the performance of governments. The topographic data provide the 'land' basis, which describes the territory, and provide a complete spatial partitioning (Molenaar 1998).

The cadastral data describe the man-tenure-land relationship (Turkstra, Amemiya et al. 2003).

3.4. Concept of Base Registers

The concept of base registers, such as census data, cadastres, legal entities, vehicles, addresses, topographical databases, is that they are guaranteed by the government regarding the availability, access, continuity, up-to-datedness, quality, and price to the society (Maanoja, Kokkonen et al. 2004). Bessemer Laarakker (2006) explained that the person register will no longer be independently describe the address where a person lives, but the Person's Register registers in the relation to the base Registers of Addresses and Buildings with which the actual address is found.

The concept also contains that it is no longer an option to collect information separately if it is also available in a base register. Administrative and Geo referenced linking are done with the help of unique identifiers and by using the location on maps. To link an address to a person is done by combining the identifier of the premise which has an address with the corresponding person identifier. This relation is maintained until some change has occurred like the person moved to a new address. If information in a key register shares the same location with information in another key register then there is a geo referenced link between them. The used maps must be of the same precision otherwise wrong relationships can be derived from them (Ellenkamp and Maessen 2007).

3.4.1. Netherlands

In trying to improve the information infrastructure of Netherlands, the Government introduced concept of base registers. According the government, system of base registers is one of the means to improve services to the people. The system of base registers will make sure that share of information is easy and that it becomes unnecessary to store the data itself or to keep track of changes itself. With these developments a lot of formal forms and related procedures are not necessary any more. This will save money, time and effort (Stoter, Quak et al. 2007).The ultimate goal is that within the Netherlands, the government will be customer oriented and pro-active. The base registers are amongst others the registrations of:, Buildings ,Addresses ,Cadastral Parcels ,Persons Companies, Topography (small scale and large scale) and ,Real estate value (Ellenkamp and Maessen 2007).

This Base register is regulated by law and there is the Base Register of Addresses (BRA) which lists all towns, street names and house numbers and the Base Register of Buildings (BGR) which contains data on buildings, premises, (semi) permanent locations and jetty. They are combined into one key register because there is a strong link between a building and the addresses involved (Bhatkar, DuVarney et al. 2004). In the base Register of Cadastre, a cadastral parcel is registered. This parcel belongs to owner who is registered in the base Register of Persons. Therefore in the Base Register of the Cadastre a relation is established to the specific person who is the owner of the parcel in the base Register of Persons. Through this relation the base Register of the Cadastre can find the personal data and the address where this person lives. In the base Register of Persons, a person is registered.

It is important to note if a person lives in a premise which has an address and is registered in the base Registers of Addresses and Buildings, then in the base Register of Persons a relation is established to the specific premise in which this person lives in the base Register of Addresses and Buildings. Through this relation the base Register of Persons can find the address where this person lives.

3.4.2. Denmark

The address system in Denmark is regulated by the legislation that is concern to the central civil registration and property registration, e.g. registration of buildings, dwellings and land property(Lind 2000). The Danish Central Register of Persons (CPR) act from the late 1960s and the Building and Dwelling Register (BBR) act from 1977 form the basis of the public authorities' administration of street names and address (house) numbers(Lind 2000). Addresses assigned to individual dwellings must be unique(Lind 2008). This entails that residential buildings with more than one main entrance door or stairway are addressed with an individual address number for each individual stairway. Correspondingly, the assertion on uniqueness of location entails that if two or more dwellings have access through the same stairway, each dwelling must be assigned information about floor number and door designation. (Lind 2008).

Every named street is assigned a unique, three-digit municipality code and four-digit street code (Dael, Frederiksen et al. 2008).The information element will include, among other things, concrete information about build-up area of a correct address, about important visible road names and address number signs are suppose to be made available. For example for mail to be delivered correctly, and for turn-outs to arrive quickly (Schröder 1997).This address system is uniform over the whole country of Denmark and includes towns as well as rural areas in all municipalities

3.4.3. Finland

The Base Registers in Finland are national information systems that identify the basic units of society. These basic units include persons, corporations, buildings and real estate (Karttunen 2001). The Base Registers should contain information concerning persons, corporations, building and real estate. This information is of vital importance to public sector and to society at large(Kurri, Laakso et al. 2004). Each register describes the state of the basic unit, as well as events which may have caused this state to change. Characteristics of the Base Registers include broad coverage, reliability, versatility and data protection (Varis, Pellika et al. 2004). Funding of the national basic registries is mainly provided by the Government. However the funding of the maintenance of the national topographic database and cadastral system is based on partial cost recovery. The Finnish Council for Geographic Information council includes all the key central government departments, local government, and the private sector. Several actors are actively involved in coordinating GI Capacity Building.

Persons and corporations are linked to buildings by identifiers, as are buildings to real estate units. The integration possibilities provide an opportunity to use data in many combinations. One demonstration of possible applications is the census. From 1985 onwards, censuses have been carried out by the Base Registers without any data collection using forms (Loikkanen, Rantala et al. 2006). It is possible to use up-to-date data from the Base Registers at all times. Because all persons and corporations have been linked to buildings that have coordinates, it is possible to do very detailed spatial analyses of socioeconomic data. The analyses can be made without being based on administrative area divisions.

The identifiers for buildings, dwellings and places of business are derived from the real estate unit identifier. The Cadastre also provides data on administrative divisions (Jakobsson 2006).

3.4.4. Address as Base Register

Documents for addresses include names of towns/cities, municipalities, streets, house numbers and postcodes (Breunig, Bär et al. 2005).Addresses are always important in registration regardless of whether persons (home addresses), businesses (business addresses) or buildings (object addresses) are concerned. For example in Netherlands what make an address included the residence unit and person. An example of address base register of the Netherlands is BAG. The aim of the BAG is to facilitate multiple use of this data by government agencies (Zevenbergen, Hoogerwerf et al. 2006). The catalogue of products and services will be developed and will be available online(Van der Molen and Welter 2004).Government agencies must prepare the implementation of the BAG in good time, as this will affect many information flows and processes within their organizations (Besemer, Laarakker et al. 2006).

3.4.5. Concluding Remark

In concluding this chapter, the research found that it is logical to say that there are different addresses within the public sector, also in many organizations and places. In the nutshell, I conclude that address is a core object that links geo-information to societal information in a database (concept of base register)

4. METHODOLOGY /FIELDWORK

4.1. Introduction

To answer the research questions and gain insight in the level of usage, perceptions and evaluation of addresses, the research review different literature on the concepts, history, development and use of address. This analysis was based on a number of international literatures. Data collected from number of governmental organizations in Dar es Salam, Tanzania.

The research proceeded with field work in Dares Salam, Tanzania which started on the 2nd to 27th October, 2009. While in Tanzania, the fieldwork was facilitated by Dr Mrs. Agnes Mwasumbi and Mr. Felician Komu both of Ardhi University Dares Salam Tanzania.

Data is very vital and important for any research to be conducted and such data can be collected by four methods; communications, observations, instrumentation and participation (Kumar 2005).Cases based research is ideal for the research that it allows the use of various methods to obtain data for the research (Msuya 2009).

Multiple sources of evidence were used for the data collection, which provided convincing findings that were based on several sources of information (Yin 2002)((Yin 1994).Due to the flexibility of the structure contents and questions of unstructured questionnaire interviews, dominated as the data collection method. Closed and open ended questions were used by the researcher to get the opinions, perceptions and factual information. Discussion with some of the interviewees with experience with the subject area 'address data' was conducted at the end of the fieldwork, during then, the data for the first interviews were validated. The perceptions, impacts and understanding of address data were discussed.

4.2. Study Area

The study area is Dar es Salaam Region and is one of Tanzania's 26 administrative regions and the capital. Dar es Salaam is the wealthiest region in Tanzania and the most densely populated with 1,786 people per square mile. The region of Dar es Salaam has the population of 2,487, 288 according to the 2002 national census. The region also has the second highest population growth rate of 4.3% after Kigoma region. 93.9% of the total regions population lives in the Dar es Salaam Metropolitan area. It is divided into three administrative districts: Kinondoni, Ilala, and Temeke (Kaaya 2004).

4.2.1. Objective of fieldwork

The fieldwork was importance for this research because it helps the researcher to assess the creation of addresses, the use of addresses within the public sector, assess feasibility of a base address register. To confirm the Western concept on address as base register of public sector.

4.2.2. Data collection methods

There are two main approaches for the data collection through primary and secondary data sources .in this research both and others methods were used to collect data. In the case of primary data field observation and interviews methods were used

- Object-oriented models of addresses as a spatial object using (UML) was used
- Literature review on addresses within the public sector
- Incorporation of spatial model
- Comparison of findings, modeling with fieldwork
- Conclusion on Field Observations in the Urban city(Tanzania)
- Camera was used to take photographs of some addresses on bills boards, street names and house numbering formats.

The city is typically a developing metropolitan and as part of the field observation researcher went round the city and saw the status of addresses. Table 4.1 show address types in Tanzania.

ADDRESS TYPES

4.1 address data in public sector in dare salam

Traditional formalized address type **Semantic**	
Street Name	Magogoni road, Luthuli street
Intersection Address	Corner of Sinza and Uhuru road
Site Address	51,changombe road
Composite Address(semantic)	
Land marks	Kilimanjaro Hotel ,city centre Ilala
Building Address	NHC, Shirika la Nyumba la Taifa plot no 19/53 Uhuru street
Descriptive Address	
Mental maps	By Bagamoyo road, Mwanza
Virtual Address	
Internet Address : website: http://www.aru.ac.tz	Email: recoengineering@bol.co.tz,
Post Office Address	
Postal box:	P.O. Box 2345,Mwanza,
Telephone	
Land line, mobile :	+255713313478

4.3. Use of addresses

Field observations showed that, the use of electronic address such as emails was very high in most of parts of the city. Another prominent address use by people was mental maps, especially by the Taxi drivers. Another important use of address as observed in the city was postal box (PO Box), and phone numbers (mobile, land line)

4.4. Public organizations in Dares Salam

The researcher visited some government agencies and saw how addresses were use for official registration procedures in the public sector. The address datasets of some of these agencies are shown in figure 4.2

Organizations	Postal box	Emails	Telphone	Coordinates	Zone code	House no	Street no	Plot no
Tanzania Post Office	P	E	T	-	-	-	SN	-
Tanzania communication regulatory authority	P	E	T	-	-	-	SN	-
National Housing Corporation	P	-	T	-	-	HN	SN	-
Land Department	P	-	T	-	-	-	-	PN
Business registration and liaising agency	P	-	T	-	-	-	SN	-
Tanzania Revenue Authority	P	E	T	-	-	HN	SN	-
Ilala Municipal	P	-	T	-	ZC	HN	SN	PN
National Bureaus of Statistics	P	-	T	-	-	-	SN	-
Dar es salam Water &Sewage Company	P	-	T	CO	ZC	HN	SN	PN
Kinodoni Municipal	P	-	T	-	ZC	HN	SN	PN
Tanzania Electricity supply company	P	-	T	CO	ZC	HN	SN	-
Department of Surveying & Mapping	P	-	T	CO	ZC	-	-	PN

4.2 summary of address date public sector in Dares salam

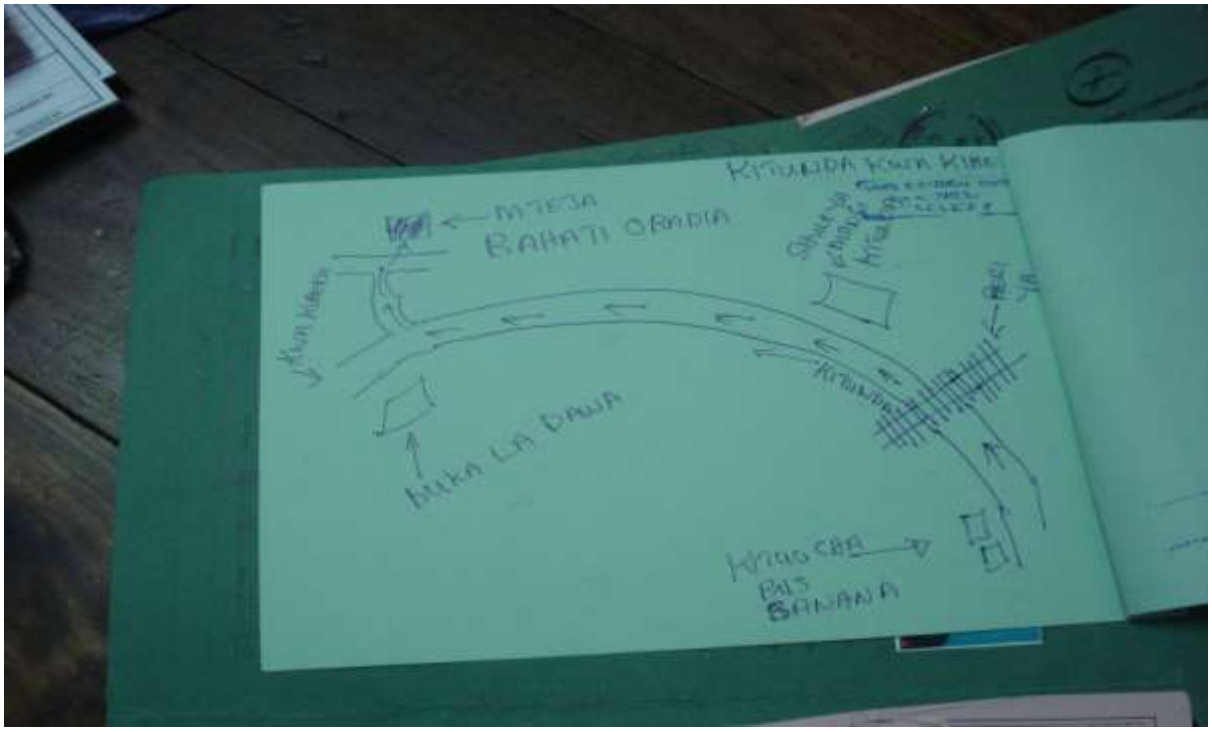
Source code: P=postal box, E=email, T=telephone, CO=coordinates, ZC=zone code, HN=house number, SN =street name, PN=plot number

4.1 sample of street address

The researcher found out that some parts of the city, addresses are of street names and housing numbers are well organized, see figure 4.1 above. In some parts less organized while in parts of the city m address is completely absent.

4.4.1. Department of Surveying and Mapping (DSM)

This organization carries out plot surveying and allocates plot numbers with coordinates to the surveyed plots as geo- address (coordinates) and is use to keep records of surveyed plots and parcels. Sketch map for locating service point before actual survey is done. Mostly used by land survey department and Tanzania electricity Supply Company usually for slum areas or areas that do have spatial planning. Figure 4.2 below is referred.



4.2 sample of address for service point

4.4.2. Department of Land (land registry)

In the official procedure of this organization for land registration, they combined plot number and home address (semantic) of any person, group of persons who wish to apply for land allocation

(applicants) as a requirement for the registration and request for other data like postal box number, phone number and emails see table 4.2.

4.3 sample of mix address (semantic &virtual)

4.4.3. National Bureaus of Statistics (NBS)

In this organization, postal box, mobile phones and emails are required for their official procedure of registration of business names. Less importance is attached to the semantic address. All other agencies visited, it was noticed that they have a similar form of addresses used in the procedure of registrations to that of department of lands and business regulations and liaising agency. Figure4.3 above is a sample of mixture of semantic and virtual address used by the national bureaus for statistic for the registration of companies.

4.4.4. Tanzania Revenue Authority

The Tanzania Revenue Authority *(TRA)* is a government agency of Tanzania, charged with the responsibility of managing the assessment, collection and accounting of all central government revenue. It is a semi-autonomous body that operates in conjunction with the ministry of Finance and economic Affairs. It monitors the performance of the economy. Figure 4.4 below is sample of address use by the organization for property tax collection

4.4 property tax address sample

4.4.5. Tanzania Communication Regulatory Authority (TCRA)

This agency is an independent authority for the postal, broadcasting and electronic communication industries in the united of Tanzania and is charged with the responsibility of licensing and regulating the postal services, broadcasting services and electronic communication sectors. Tanzania mobile subscribers will have to register their personal detail for their mobile phone SIM cards with the authority. According to the TCRA the move is being done so as to curb misuse and keep track of owners. As a result, all buyers of new SIM cards will now be required to present their identification as they purchase them. There is something worrying about this action from the TCRA since it may give

the Tanzanian Government an almost uncanny ability to monitor all Tanzanians, wherever they may be from their telephone conversations, text messages, internet activities and their locations at any time.

4.4.6. Local Governments

In all the municipalities visited, the researcher found that creation and maintenance of semantic addresses were completely lacking and there is lot of backlog of addresses of new streets to be named. Some reasons were given by some officials of the municipalities that even thought they are constitutionally empowered to create and maintain the streets and house numberings, but they do not have the capacity to do due to lack of budget for such projects. Furthermore in the procedure of government functions, in some places, semantic address is for tax collection. Postal box numbers, mobile phones are required for registrations and delivery of mails and messages. Figure 4.5 below sample of address used by the municipalities.

4.5 municipalities address sample

4.4.7. Concluding Remark

The chapter found that there are semantic addresses within the city and government agencies. But mobile phones, emails and postal box are most frequently used service channels as indicated in Table, 4.2. Conclusion can be drawn that in all government Agencies visited, use of electronic means of communication was higher in registration procedures of government business. The data require for registrations in the public secotr are postal box numbers (P.O.box), phones (mobile or landline) and emails. Less use of semantic addresses is required.

In the official registration procedures of government business in Dares Salam, not much attention is given to semantic address because the semantic addresses are neither organized nor up-to-date that make the public sector to rely on the new types of addresses such as mobile postal box and emails than the traditional semantic.

5. DISCUSSIONS AND CONCLUSION

5.1. Discussions

The main objective of this research is to understand the origin, functions and uses of addresses within society and the public sector in particular and sub-objectives are. **1**. To understand the role of address in geo-information infrastructure and base registers. **2**. To develop a conceptual frame for address as social/spatial object. **3**. To explore the current status of address datasets within public sector in Tanzania **4**. To classify address in order to understand the use of addresses in the modern society

5.1.1. Base Register Concept

First point of discussion is on the concepts of base register in Western Europe, taking three cases (Netherlands, Denmark, and Finland) on address datasets as one of the proposed base registers of the public sector. Western Europe is trying to develop or to establish base registers with geo-information infrastructure to link other objects where address is a spatial entity to a building.The registers should be normalized,uptodate, and should be available to every user who need it (Besemer, Laarakker et al. 2006).

Denmark base registers:

Denmark has law governing the building and housing register to ensure that each individual dwelling is assigned a unique address designation which is registered by the municipality. The dwelling address must be unique. residential building with more than one main entrance door or stairway are addressed with a house number for each individual stairway (Lind 2008).

The principle of adaptability, states that all data should be collected only once, after which it can be used via the information service by other authorities and those who need the information. The law also provide data protection for the data access and delivery are strictly regulated. The Base Registers defined by the above criteria consist of the Personal Information System, the Business Information System, the Land Information System, and the Building and Dwelling Information System (Bhatkar, DuVarney et al. 2004).

Netherlands base register.

The government proposed some criteria for the base registers such that the registration is regulated by law, compulsory use by the public institutions, the client have a report obligation etc.The planned base registers include natural person, legal person, buildings, addresses, cadastre and topography. The government within the Netherlands want to improvie its information infrastructure to people by creating base register. Government believe that this information infrastructure could be achieved through the development of these registers.

The system of base registers makes sure that share of information is easy and that it becomes unnecessary to store the data itself or to keep track of changes itself. With these developments a lot of formal forms and related procedures are not necessary any more. This will save money, time and effort. The ultimate goal is that within the Netherlands there is a government that is responsible to the people (Ellenkamp and Maessen 2007).

The idea of base registers by the Netherlands is a well come idea but some of these base registers are not easy to create. For example address base register as Besemar et al(2006) Point out that after a start-up period of more than 10 years the register are not completed. The Dutch government has announced the development of nine basic registers for the time being, which will pertain partly to persons, partly to immovable property, partly to vehicles and partly to financial matters. And example of Netherland address base register is BAG

Finland base register

In the case of Finland, the plan for base register started in the 70ties as pointed by Leskinen (2000) who attested the need for a nationwide Land Information System that would contain both data of the Cadastre and Land Register was not computerized. The computerisation of the Land Register did not started until in1984. It took till 1994 when cadastral alpha/numerical data covered the whole of Finland was developed (Arvo Kokonen 2004). According to him the delay in the implementation of the base registers was due to lack of proper legislation.

Legislation is needed to change the current Land Information System into a statutory national register and information service system because it will establish the obligations and rights which can be approved by the society. Funding of the national basic registries is mainly provided by the Government. However the funding of the maintenance of the national topographic database and cadastral system is based on partial cost recovery. The Finnish Council for Geographic Information council includes all the key central government departments, local government, and the private sector. Several actors are actively involved in coordinating GI Capacity Building

Observations

After careful reviewed of cases from the Netherlands, Denmark and Finland. It is clear that to develop base registers for the public sector is not easy. For example, the central government of Finland has not been able to develop all the needed base registers (Jakobsson 2006). Municipalities in Finland had to develop their own systems that could support their municipal administration. Turkstra et al (2003) attested that there is often little or no cooperation between local and national government. They trend to manage and maintain the national address database by adding local data to a single centralized database and periodically publishing the national database is seen in the examples of national databases described by Jacoby et al(2002) ,McDougall et al(2007) for Australia, and by Morad (2002)for the UK

5.1.2. Tanzania Case

Second point of discussion is the Tanzania Case: In the Tanzania the status of address data is poorly develops that was found out when I went round the city of Dar es Salam. In most part of the city, the semantic address is partially developed while in some part of the city, the addresses are completely not absent. I also visited public organisations and saw how public sector use addresses but I noticed that in the official procedure of Government business in Dares Salam, the semantic address is not very much use, this is because the address is neither complete nor up-to-date.

In most offices they have resolved to electronic addresses such as emails, mobile phones. These new types of address are also use within the society to send or deliver messages. The government can find any citizen if they want to, this is because government of Tanzania has put so much importance in the use of new technology by establishing an agency charged with the responsibility of registering all electronic forms of communication in Tanzania. Van Deursen (2006) added that the Internet and encouragement by the commercial success of the private sector in the past has made the public sector to rapidly embrace the Internet as the means to improve public service delivery.

According the government of Tanzania The registration will include all the Network providers and users. Once the detail of your mobile phone and emails are registered, you can be found you anytime, anywhere. Another reason is that if a citizen misplace or the phone is stolen, he can be replaced with the same SIM number, he or she had before. In doing this you will recover all your contacts. Government can equally find you if they want find you.

With what I saw in Tanzania and also difficulty in developing address database with the experience of the west and in manner which government of Tanzania have resolved to embrace the new technology in their official procedures and registration of government business. It is very difficult for the government to develop address as a base register because of the problems associated with semantic address. Government have high reliance on the new technology.

5.1.3. Comparison of Western Europe Case and Tanzania Case

In the analysis of the two cases, there is no base for comparison in term of address data management and concept of base registers. In the western Europeans countries, they have taken the pain, time and resources in the processes of harmonization, cleaning and creating standards in order to develop these base registers and it took them a long time. Tanzania government have no priority in developing address as base register for the public sector because they have embrace the new technology.

5.1.4. Concluding remark

The concepts of address as a base register of the public sector as we found in the western Europeans countries. With the advancement in the communication technology we found that Semantic address in the western European countries is outdated concepts because people are mobile. ‘Address’ by definition is a means to find a person at a certain place semantic address is a typical hierarchy address of a place name which is the country-state-city- street- house-person. There are other forms of addresses such spatial address (coordinates) finally I can conclude that address is a mixture of coordinates and linguistic place name address and societal object.

5.2. General Conclusion on Research findings

This study has found that there are different types of addresses use within the public sector. Municipalities are responsible for creating address datasets and the elements require are country, state, municipality code, street name, house number, and possibly apartment number. This is typical hierarchical semantic place name address. No single organization in Tanzania is involved in creation of address datasets. The study also found that address is largely use by society (societal object). Public sector are the largely users of address datasets. The concept of developing a base register in Tanzania as it in the western European countries is not a priority of government of Tanzania. The research has provided answers to all research questions based on the understanding and findings during the research.

QUESTION ONE**:**
What are the origins of addresses in the history of mankind?

Conceptual model of space in chapter 2 provided answer to this question. In that chapter space was consider as a super class object.UML modelling technique was use to decomposed space into place and non place. The place gets a name which in this research, it is considered as the first level of address. The name often refers to what can be observed in the area (Where You See Is Where You Are) .Actually address came from the nomad. The name is an attribute of the land object (area).

QUESTION TWO**:**
How does the public sector create and use addresses in their different Operations?

In try to provide answer this research question; the research answer is in two parts. One is on the creation of address in the public sector and the second one is on how public sector uses addresses
Addresses are created by the municipalities and the elements that are included in address creation are country, state, municipality code, street name, house number and possibly apartment number. This is hierarchical in nature and also semantic. The uses of address dataset within public sector include the following:

- Social Services Delivery: although an address does not include any demographic information, but clear indication of density of human activity. These densities can assist national departments for planning and social services such as health clinics, schools in a country. All these social service need addresses to locate where they are.

- Municipal Services Delivery: The supply of services such as water and electricity uses spatial address databases during planning. Spatial address databases are used to plan where to deliver such services, to coordinate and maintain the service networks. These services are either delivered by local government or by utility companies. Municipalities use address for tax collection. Addresses are very important to bring service to in place or location.

- Goods Delivery: Courier, freight and logistics companies use spatial addresses to deliver goods delivery locations. Spatial addresses can be used at various stages of the delivery service, starting with address verification when the order is placed. Routing when the delivery schedule is worked out, and ending with the driver using a map to deliver the goods at the requested address.

- Census and elections: For the planning and execution of a Census, spatial address databases are used for the delimitation of enumeration areas. Address is requiring for planning and execution of surveys and display of Census results. Similar to the Census example above, electoral organizations use spatial address databases for the delimitation of voting districts and the identification of voting stations in a country (Proenza 2003).

- The cadastre (land register) needs information on the plots and owners from the register contains identified and delineated public and private parcels. Land administration includes cadastral surveys to identify and subdivide land, land registry systems to support simple land trading, and land information systems to facilitate access to relevant land information, such as land value, land ownership, etc. Although the actual address numbering system differs from country to country, addresses for land identification are usually closely linked to any land administration systems (Akpoyoware 2003).

- Emergency Services: spatial address database can be used to locate the emergency point. The above examples illustrate the need for addresses by the public sector

QUESTION THREE

How addresses are handled in geo-information infrastructure and base register in western Europeans countries?

Good practices and the lessons learned from the developed western European countries are showing that a significant efforts and resources are dedicated on development of the basic and authentic registers. Developments in western European countries are going on regarding the creation of so-called base registers. The concept of base registers, such as census data, cadastres, legal entities, vehicles, addresses, topographical databases is that they are guaranteed by the government regarding the availability, access, continuity, up-to-datedness, quality and prices. For example in Finland, following the Policy Decision of the Council of State of 5 February 1998, 'base-registers' are under development regarding persons, enterprises, corporations, buildings and real estate (Kekkonen, 2004).Address is one of the proposed base registers in the western Europeans geo-information infrastructure

QUESTION FOUR

What is the current status of address datasets within public sector in Tanzania?

The current status of address dataset within public sector in Tanzania show that management of address data is very low because the addresses are not well organized especially the semantic address. In the official procedure of registration in government agencies in Dares Salam, the use of semantic is not very important. Public sector has resolved in using modern address such as emails and mobile phones in the daily and official procedures in registration of government business.

The modern addresses such as mobile phones, emails and geo-address are product of technology of the private sector has become necessary. Semantic address is becoming less important as a result of the difficulty in developing it by the public sector information infrastructure. It is interesting to note that a country like Tanzania ,far behind in term of technology and man-power has found solutions with the modern addresses (emails, mobile phone) as new information infrastructure within the public sector.

QUESTION FIVE

How does the situation in Tanzania compare to western developments in addresses data management?

In the analysis of the two cases, there is no base for comparison in term of address data management and concept of base registers. In the western Europeans countries, they have taken the pain, time and resources in the processes of harmonization, cleaning and creating standards for the data, to develop theses base registers and it took them a long time develop it. In Tanzania all these processes of cleaning data, standards technology of database concept are not available. The possibility of the developing address as base register is not a priority for the Government of Tanzania as was revealed during the fieldwork

QUESTION SIX

Can the different types of addresses be classified within the modern society?

In order to classify different types of address within the modern society,

- Mental map and Place name are first level of address. Place indications are composed of a place name with some complementary information, such as distance or direction.

- Semantic addresses – this is the second level of address. It is more complex when society becomes develop economically, and urban specialization becomes complex. More people in a small area- higher resolution to find a person

- Spatial address also known as 'coordinates' developed by land surveyors. It is not easy to because different to interpret. (Coordinate systems has been invented for long time but not tied to the semantic address.

- Postal address, this is the fourth level of address and very popular in use by the society. It is of two types Postal code which is spatial specific and post box is less spatial and is centralised in the local post office- person specific.

- Electronic address, it has two widely used types: Telephone number – land line more spatial than person and the second is Telephone mobile number – person specific, spatial independent

- Email address**:** this is one of the latest address that it is use almost all over the world ,it has no geographical boundary and like POBOX but is person specific, spatial virtual and also call cyberspace

- IP address – spatial specific zooms in via provider service area to the location of a computer
  Computers use IP addresses to locate and talk to each other on the internet, much the same way people use phone number to talk to another on the telephone. In layman terms it is the same as your home address. In order for you to receive mail at home the sending agent must have your correct mailing address (IP address) in your town (network) or you do not receive mails, or deliver the mail to recipient

6. LIMITATIONS, RECOMMENDATIONS,

6.1. Limitations of research

- The major limitation of the research is the absent of any private sector involved in the development, creation and maintenance of address datasets within Dares Salam. It was not possible for the research to test the theory of resource dependence as was proposed in the research. It makes it difficult to model and predict the level of usage of modern address.

- Another limitation of the research is the time for the fieldwork was short for the researcher to visit some core public sector users of addresses such as Tanzania electoral commission and some private organizations.(DHL,UPS, couriers service)

- Nevertheless the limitations were solved using multiple sources of evidence in mutual way. A porch was introduced and non-conforming observations were ignored. There were continuous discussions with some professional and colleagues throughout the research period.

6.2. Recommendations

After studying the existing situation about addresses in Tanzania and the concept of address base register of the west. It is difficult to recommend any further study for Tanzania, because the Government of Tanzania has claimed to have found solutions to the semantic address problems.
Even though the conclusion stated that it will be very difficult for the Government of Tanzania to engage in the development of address base register. The researcher still recommends that research in that arena is required to grasps what exactly the problem is.

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8. APPENDICES

Course: **Geo-information Science and Earth Observations**
Degree: Msc.
Research topic: **Addresses in Geo-information Infrastructure**

Introduction: Structure questionnaires and interviews were developed for the purpose of collecting information to support my study. Confidentiality of the respondent is highly valued, so all personal data collected are not to be disclosed openly otherwise without the permission of respondent.

Appendix 1 Questionnaires for the interview

The interviews shall be an open ended which intends to generate discussions between the researcher and the interviewees. Depending on the way of the interviews, more questions shall be developed accordingly.

Category 1(Organization Structure)

Can you briefly introduce your organization?
What is the mission, vision of your organization?
What policies and or regulations guiding your organization?

Category 2(Information perspectives)

How does your organization compile address data?
Who keeps the address data in your organization?
When does your organization compile address data?
Which object or element gets an address in your organization?
Do you know any organization that is involve in developing address data?
In what format do you keep address data in your organization?
What is the spatial coverage of an area by your address data?
How do you check the quality of the address data in your organization?
Do you have any mandate to share address data with another organization?
How do share your address data with other organizations? Is it free or pricing?
What is the cost of creating or developing of address data?
What is a post code or a ZIP code?
Do you know where your water meters are located?
How do you maintain and update your address data?

Who update your address data?

Appendix 2 Themes and Responses

Category A: (Institutional arrangement)

Methods of collecting data and exchanging information within government or private agencies require some policies or regulations.
Policies are not the problem but implementation is always the issue
Policies and regulations do not exist in our organization regarding address data.

Category B: (Collaboration and Address Data sharing)

No such collaboration with other organizations
Developing countries, their government are so supportive in ensuring that there is a network of collaboration from the various organizations hence the success.
We collaborate on friendly basis with TRA, NBS, TCRA, and many others.
All our address data is for free to other users
We have no any formal ways of collaboration, just personal contact with colleagues from other organizations since we are all working for the same government of Tanzania
Information sharing could be possible if people are aware of the procedures and contributions.

Category C :(Opinions and Perceptions on Addresses)

People do not value the use of addresses
People do not appreciate the cost of compiling address datasets, it is very costly to produce complete or update address datasets.
There no clear way of achieving spatial and social equity just because the district roads become the national roads after some infrastructural development.

Category D: (Standards and Quality)

There are no standards for address datasets people are not willing to share, for this reason the data is not complete.
There are quite number of data sources but the data is not standardized and they do not match
We have ways of checking the quality of our data, field survey is compulsory even when we get the data from the customers.
The quality is check on routine base

Category E: (Data Completeness)

The address data is not complete, format varies. The data is not accurate and up to date.
The datasets are incomplete in quantity, quality and coverage.

Appendix 3 List of participants in the Interview

s/no	Name	Organization	Email	Phone Number
1	Surv. John A Nsenwa	DSM		
2	Mr Shawuya	LD		
3	Agyrey E Mhecha	TPC		0713313478
4	Surv. Baraba DA	Ilala Municipality		0754526320
5	Mr Gudaba J MM	TPF		0713498870
6	Magessa Magesa	Kinondoni Municipality		
7	Mr Wilfred N	NBS	wmwingra@nbs.go.tz	
8		BRELA		
9	Engr. Richard	TANESCO		0754266006
10	Mr. Fikiri Salla	TFRS		0713409568
11	Yubenal Mabuli	DAWASCO		078426067
12	Mr Photideos Kegimbo	Temeke Municipality		0713568120
13	Simba Albinus	NHC	simbak@yahoo.com	0713246447
14		TCRA		
15		TRA		

Appendix 4 Responses from the Agencies

Responses from Department of Survey and Mapping

Date: 6/10/2009
Location: office
The respondent answer all the questions posed to him by summarising that we in survey and mapping department do not keep or generate addresses hence we deal with plot numbers and coordinates. He further said, the dept do not located plots addresses of allottees not necessary.
One of the departments' responsibilities is to check that survey work is done correctly according the surveying laws and regulations of the country

Responses from Land Department

Date: 19/10/2009
Location: office
He responded to the questions by saying 'Yes' we use addresses a lot for registration procedures of our activities in the department. In the registration procedures for land allocations, we expect the applicant to submit the following: emails, mobile phone numbers, postal box, house numbers and street names. He further said that we keep the list of addresses of all allocations manually for our internal and we don't give it out hence it is confidentially. Postal box is one of our major requirements for address of the applicants and must be in included in the application of land.
We have started the registration informal settlements by identifying every building and issuing out building licenses and which a database is developed of informal settlements.

Responses from Tanzania Post Commission

Date: 16/10/2009
Location: office
Our major duty is to collect, distribute and deliver. In order to deliver the mails to our customers, we first of all, identify areas where we have large number of customers and then allocate a delivery point called delivery office. Postal offices are planned in such a way that the numbering start from the lowest number, for instance in Dar es Salam we start with one and it increase gradually.
He told me that we do not have post code in Tanzania because it is not well planned such as having streets names and so on. Addressing in Tanzania must have a posting stamps number to differentiate it from zones within the area. And this stamps number do not change
The researcher asked what happen a customer fail to pay his annual bills but he responded that they organization send him a letter of reminder and if he fail again three time, he post box will be withdrawn and lease to new customer but the post box number will not change, what will change is the post stamps and his name.

Responses from Ilala Municipality

Date: 19/10/2009
Location: office
The respondent told that the municipal council is responsible for the street naming and the house numbering, but the streets and house numbering are not update nor complete because council is lacking funds for such project. He also explained that there are not current maps covering the city and make it very difficult to create new street names. It is not easy to change street name or to update because it requires long process and is tedious. The database containing street names is being developed now. He further said house numbering is the city centre are not up to date because it is the responsibility of the national housing corporation to number the houses within the city centre of Dares Salam. When the respondent is asked on what he meant by house number 5/14, he explained that 5 is

the old plot number while 14 is the new ploy number as a result of subdivision on the plot, but we do not this as house identification number.

Responses from Tanzania Police Force

Date: 18/10/2009

Location: office

The police officers all the questions posted at the same by saying that we want to establish GIS offices in all the police station in Tanzania to ease their operations. We are working with the survey and mapping department in the ministry of land to help us capture all the police stations. When the researcher asked the police officer on how they combat crimes in the city since no street maps and address of location, he responded that, that is their major problem the police is facing today however they use descriptions, reference or popular objects within the scene of the incident. Finally he added that we are developing an address database for the city.

Responses from Kinondoni Municipal

Date: 19/10/2009

Location: office

The respondent started by explaining how street names are carried and the problems they faced. He said the procedures of creating or developing street names and house numbering is very complex and takes a long time to do. it is more difficult in the rural or slums than the surveyed areas because lack of spatial planning in such places and went further to say that the municipality is developing a databases for the houses in slum and will allocate number to them. He said if you around the city you will see two types of numbering on the building which mean different things and have different purpose. One is for property tax issue by the tax revenue authority for the purpose of collecting taxes while the second one is the plot number located by the survey department for collecting land rents.

Responses from National Bureaus of Statistics

Date: 6/10/2009

Location: office

He started by brief introduction of the office after he responded by listing elements are that required for registration in their organization. We are using ISO standards of addressing for the registration of all the business premises. Physical address is not really required because they are complete or do not exist. Yes we do not have a section that keeps addresses but we have a section that updates our address database. We update our address database in four ways through our internal survey, field survey, through newspapers, advertisements, but we rely most on our internal survey.

Of course we share our address data with Tanzania revenue authority (TRA) and business registration and licensing agencies (BRELA) however there is no official policy for us to share but it is done on personal contacts since we are all working for the same government.iam happy to let you know that the DFID of Britain is supporting us to develop comprehensive registration and addresses of all our business premises in Tanzania. On the maintenance of addresses , he told me that it is always very costly to maintain address data therefore we normally charge some fee like Tsh 400, 000 form our customers..

Responses from Business Registration and Licensing Agencies

Date: 6/10/2009
Location: office
The respondent gave brief introduction of the organization and proceeded by answering 'yes' we not create addresses but it is part of the information the customer is expected to submit with his application. Physical address is a major requirement that the customer have to include in the application form because the office would like to see location of the business premise physically on the ground. Every company that operate here in Tanzania, we must see the address before it is allowed to operate. We do not maintain the address data but we maintain the file that contains the address data. We share our address data with any organization that come to us in search of the information because we data is not confidential but for the public and anybody that wants it can get it for free.
We are the custodians of such information and our duty covers the whole country.

Responses from Tanzania Electricity Supply Corporation

Date: 23/10/2009
Location: office
He started by giving an example saying that when a customer applies for service of power supply, one of the requirements is for the customer must attach a sketch map of his house or where the service is required. After which we will use the sketch to locate the place for the first time and we will use GPS to capture the coordinates of house which will be plotted in our database. In our office we will use the coordinate's plot to route the power supply lines but this is only for surveyed areas within the city. In unsurveyed areas, we use the sketch map or land marks in order to locate the place, before we capture the coordinates. We attach address of the meter to the building but even if the occupant vacates the premises we do not change the address of the meter, it is only the name of the occupant that will be changed from the database. We service have not yet cover Dares Salam but we are in the process.

Responses from Tanzania Fire and Rescue Service

Date: 8/10/2009
Location: office
The respondent told the researcher that there are two ways in which we create or development address data for our operations. One ways is through the maps of the surveyed areas like here in the city where all the streets are defined with names. Secondly the other way is by using land marks or special marks that are very popular within the area. This is mostly in unsurveyed areas since it is not the whole of Dares Salam that is surveyed. We normally go for inspection to get familiar with the areas. We have installed fire hydrants (fire points) in all the unsurveyed area, these are fire points that the fire worker use to get water during any fire operation. You know that fire is crown puller or it attract people when there is fire outbreak in unsurvey areas; we get there by description using the land marks.

We try to divide these unsurveyed areas into blocks for easy identification and access during fire incident. I went for course to study topographic mapping but unfortunately after mu course, i found out that all our topographic maps are outdated and we cannot longer use them for operations.

Responses from Dares Salam Water and Sewage Company

Date: 22/10/2009
Location: office
After brief introduction by the respondent, he started by saying that when a customer need a connection for water supply to his house, we will request him to take the field staff to location for inspection and for the survey by the staff using GPS to capture the new connection which will be plotted in the database and after that the customer will pay for the new connection and when payment is made, address will attach to meter by a way of coding. We do not share our address data with any organization because the address is provided by the city council. We confirm the address by visiting the field or site to make sure the data supply is correct and we cannot change the address but we do is to change the name of occupant.

Temeke Municipality

Date: 16/10/2009
Location: office
The respondent started by explaining the general activities of his unit by saying that we have develop GIS unit that assist the revenue dept, education dept, in registering their businesses.
He further added that all department require address data for their operations and the address elements included plot number, telephones, emails, postal box
The researcher wants to know who create, maintain and update the street names within the municipality, the respondent told me that street names are poorly maintained and for very long time no new street has been created or updated but the council is making effort to include some parts in the 2010 budget. We have requested for the current satellite image covering the major parts of the municipality so that we can update our streets and have proper address. We have the responsibility to share address data with Tanzania revenue authority for the purpose of revenue collection but there is no any official agreement on the data collection

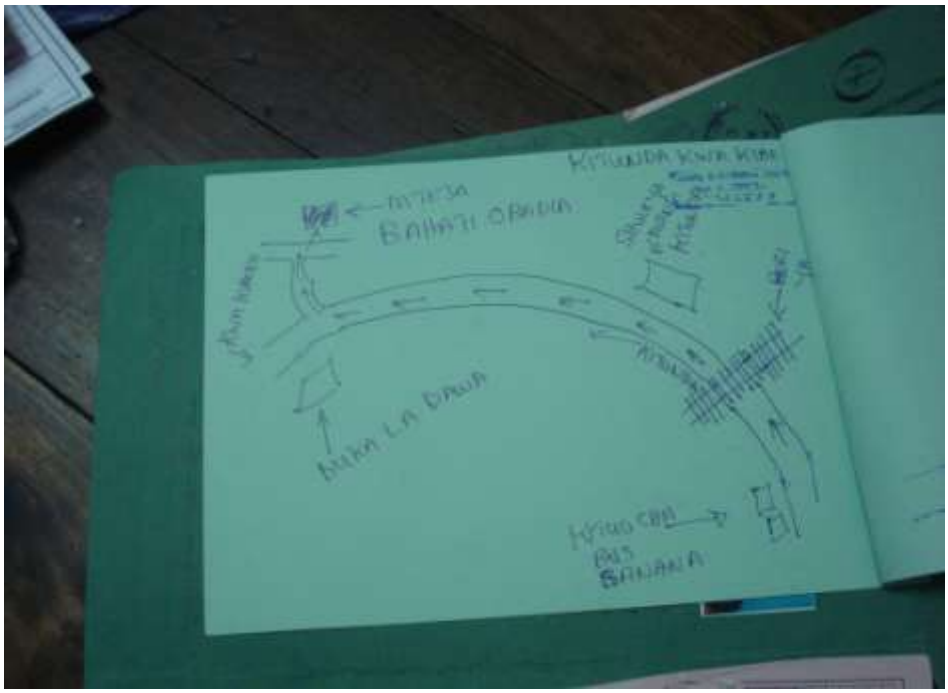
National Housing Corporation (NHC)

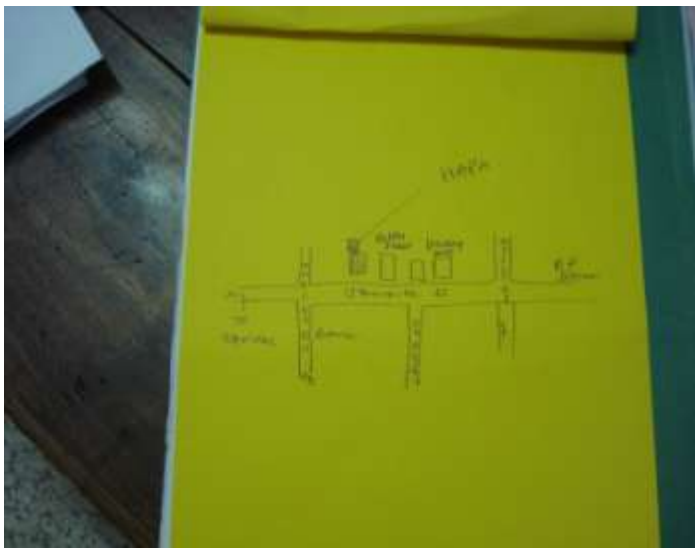
Date: 16/10/2009
Location: office
The respondent told me that national housing corporation do not create address data but the information supply by customer that come to lease their properties is what we use as address of the applicant. Yes we maintain the address as it is supply by customers when verified by our staff.
He further explained that when the address has been verified then it will be captured in our data base in the information management system dept.The researcher wants to know whether they allocate address to their houses. The respondent said yes, we allocate plot number and apartment number to be the address in the case of story buildings. Furthermore He added that the plot numbering system is

2/7 meaning that 2 is the floor number and 7 is the apartment number for the story buildings but sometimes 2 could be the old plot number while 7 is the new plot when a subdivision is done

Appendix 5 Sample of Street name Address

Appendix 6 Sketch Map of service point for DSM



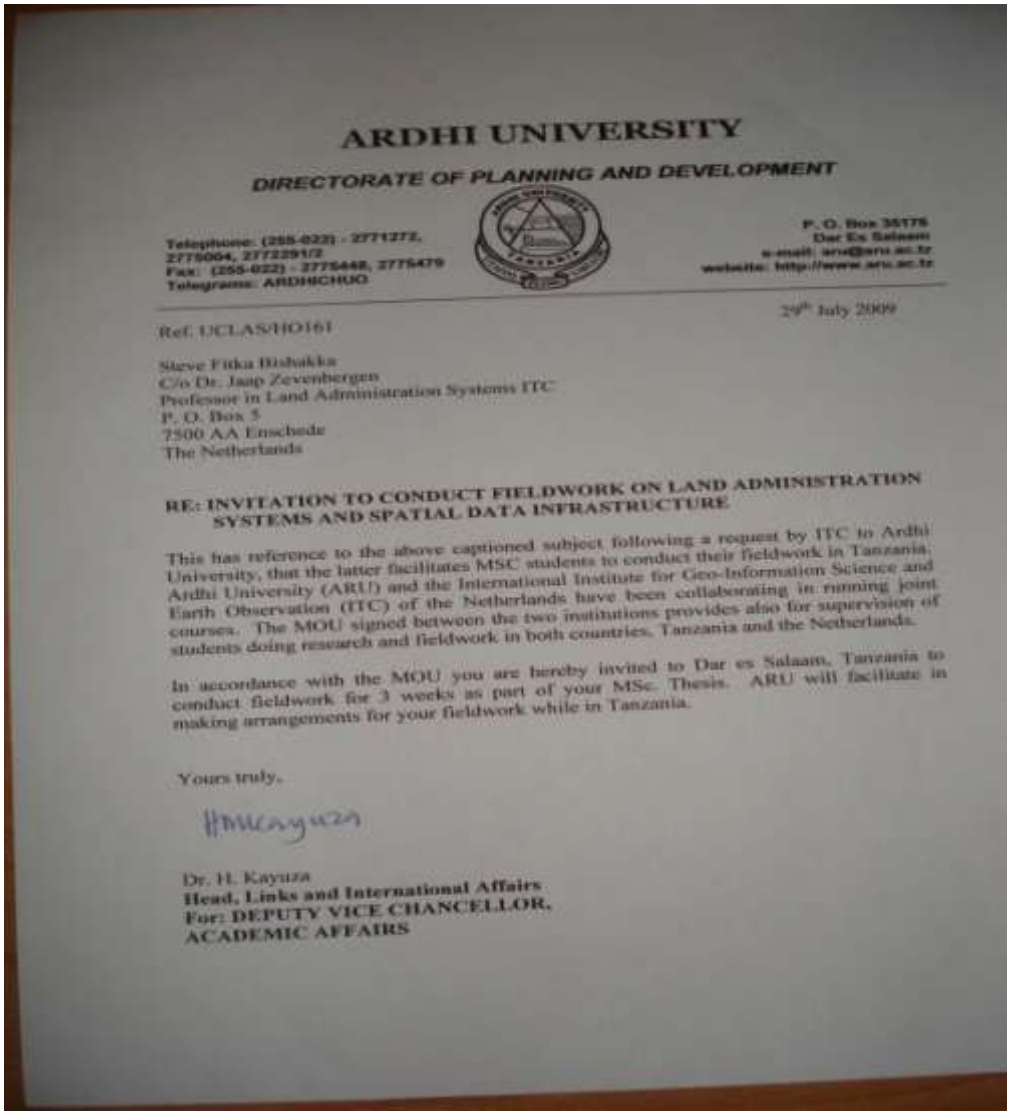


Appendix 7 Mix addresses of semantic & virtual

Appendix 8 Sample of NHC address format

Appendix 9 Sample of TRA address format

Appendix 10 Research invitation by Ardhi Uni



ARDHI UNIVERSITY

DIRECTORATE OF PLANNING AND DEVELOPMENT

Telephone: (255-022) - 2771272,
2775004, 2772291/2
Fax: (255-022) - 2775448, 2775479
Telegrams: ARDHICHUO

P. O. Box 35175
Dar Es Salaam
e-mail: aru@aru.ac.tz
website: http://www.aru.ac.tz

Ref. UCLAS/HO161

29th July 2009

Steve Fitka Bishakka
C/o Dr. Jaap Zevenbergen
Professor in Land Administration Systems ITC
P. O. Box 5
7500 AA Enschede
The Netherlands

RE: INVITATION TO CONDUCT FIELDWORK ON LAND ADMINISTRATION SYSTEMS AND SPATIAL DATA INFRASTRUCTURE

This has reference to the above captioned subject following a request by ITC to Ardhi University, that the latter facilitates MSC students to conduct their fieldwork in Tanzania. Ardhi University (ARU) and the International Institute for Geo-Information Science and Earth Observation (ITC) of the Netherlands have been collaborating in running joint courses. The MOU signed between the two institutions provides also for supervision of students doing research and fieldwork in both countries, Tanzania and the Netherlands.

In accordance with the MOU you are hereby invited to Dar es Salaam, Tanzania to conduct fieldwork for 3 weeks as part of your MSc. Thesis. ARU will facilitate in making arrangements for your fieldwork while in Tanzania.

Yours truly,

HMKayuza

Dr. H. Kayuza
Head, Links and International Affairs
For: DEPUTY VICE CHANCELLOR,
ACADEMIC AFFAIRS

Appendix 11 ITC introduction letter

TO WHOM IT MAY CONCERN

Our ref. : LA/09157/KB/jm
Date : 21 September 2009

Subject : Request for support

Dear Sir/Madam,

We herewith certify that Steve Fitka Bishakka is registered at the International Institute for Geo-Information Science and Earth Observation (ITC), The Netherlands, as a student attending an 18 month Master of Science course in Land Administration (LA). ITC is an Institute in The Netherlands, with more than 50 years experience, which develops and transfers knowledge in the field of Geographic Information Systems and Remote Sensing.

As part of the MSc course, Steve Fitka Bishakka will be doing a research titled "Addresses in Geoinformation Infrastructure". The research will include a "fieldwork" consisting of secondary and primary data collection, which will take place in Dares Salam, Tanzania from 3 October until 25 October 2009.

The following type of data will be required: all formats, characteristics, types, quality, digital and non-digital aspect of addresses.

Our Institute highly appreciates your support in providing him the necessary information during the stated fieldwork period.

We guarantee you that the information that would be made available to Steve Fitka Bishakka will be only utilized for the research objectives and not for any other purpose. Besides, Steve Fitka Bishakka will make proper acknowledgement and reference to the source of the information in the final document.

Yours sincerely,

Ir. M.C. Bronsveld
Course Director Land Administration
E-Mail: bronsveld@itc.nl

Appendix 12 Ardhi introduction Letter

ARDHI UNIVERSITY
DEPARTMENT OF LAND MANAGEMENT AND VALUATION

Telephone: (255-022) - 2771272, 2775004, 27722291/2
Fax: (255-022) - 2775448, 2775479
Telegrams: ARDHICHUO

P. O. Box 35176
Dar Es Salaam
e-mail: aru@aru.ac.tz
website: http://www.aru.ac.tz

Our Ref. ARU/A.410/SF 255/

15th October 2009

The Director General
Dar Es Salaam Water and Sewerage Authority (DAWASA)
Dar es Salaam

Dear Sir

Re: MSc Degree Student Research Work: Addresses in Geo-information Infrastructure

Kindly refer to the above subject.

The bearer of this letter is Mr Steve Fitka Bilshakka, an MSc Student at the ITC- the Netherlands. The ITC-the Netherlands have academic partnership arrangement with Ardhi University. As part of the agreement, we receive exchange students in the cognate fields taught at Ardhi University.

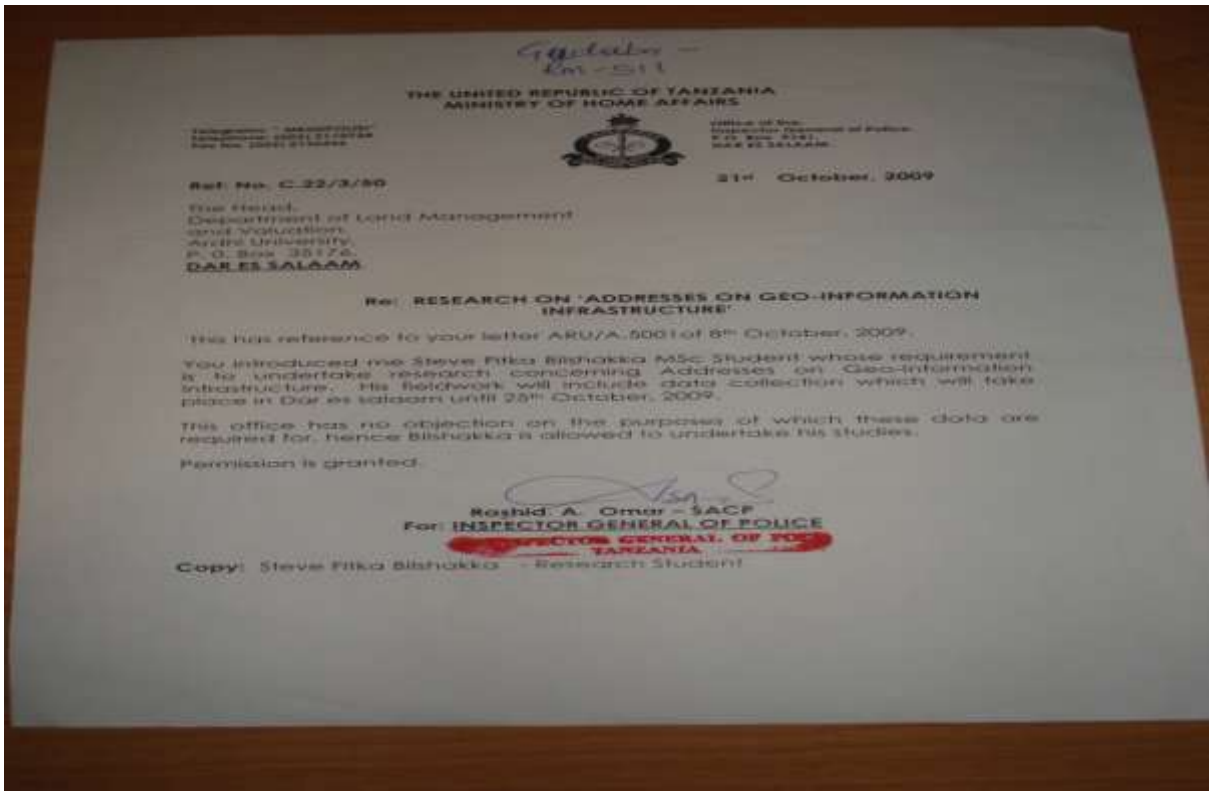
Mr Steve Bilshakka is doing field surveys as part of his MSc Dissertation on Addresses in Geo-Information Infrastructure' in Tanzania. We request that you allow him access to your office for interviews as well as to any relevant information he may need for the purpose of his dissertation.

We guarantee that the information that he would collect from you would be strictly used for academic purposes only.

We thank you for your cooperation in the training function.

Yours Faithfully

Felician Komu
Head, Department of Land Management and Valuation



THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF HOME AFFAIRS

Ref: No. C.22/3/80

21st October, 2009

The Head,
Department of Land Management
and Valuation,
Ardhi University,
P. O. Box 35176,
DAR ES SALAAM

Re: RESEARCH ON 'ADDRESSES ON GEO-INFORMATION INFRASTRUCTURE'

This has reference to your letter ARU/A.500/1 of 8th October, 2009.

You introduced me Steve Fitka Bilshakka MSc Student whose requirement is for undertake research concerning Addresses on Geo-Information Infrastructure. His fieldwork will include data collection which will take places in Dar es salaam until 25th October, 2009.

This office has no objection on the purposes of which these data are required for, hence Bilshakka is allowed to undertake his studies.

Permission is granted.

Rashid A. Omar - SACP
For: INSPECTOR GENERAL OF POLICE

Copy: Steve Fitka Bilshakka - Research Student

Appendix 13 Police Permission letter

Appendix 14 Ilala Mun permission letter

ILALA MUNICIPAL COUNCIL

Municipal Director's Office
ILALA

Date: 13/10/2009

Ref. No.IMC/AF.3/5/37
MHDE
ILALA MUNICIPAL COUNCIL

REF: INTRODUCTION FOR STEVE FITKA BILSHAEKSA

Reference is made to the letter ref.noSMU/A/5001 of 08/10/2009 concerning the above heading.

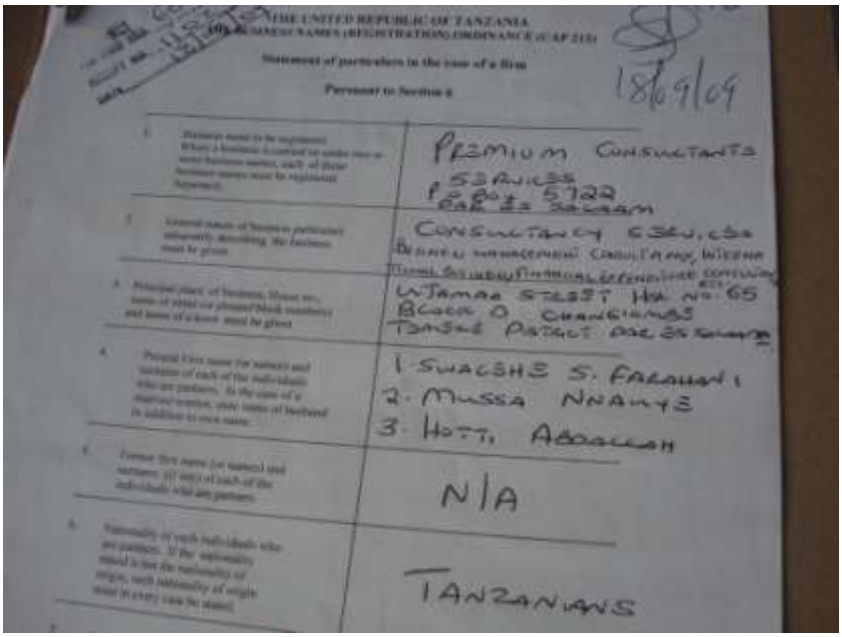
This Local Government Authority has accepted the above named student to be attached here for research concerning Addresses on Geo-Information Infrastructure.

Please assist him with all information he may require.

H.Feya
For Municipal Director
ILALA MUNICIPAL COUNCIL

Copy to:Steve Fitka Bilshaeksa

Appendix 15 Sample of application form for land allocation



THE UNITED REPUBLIC OF TANZANIA

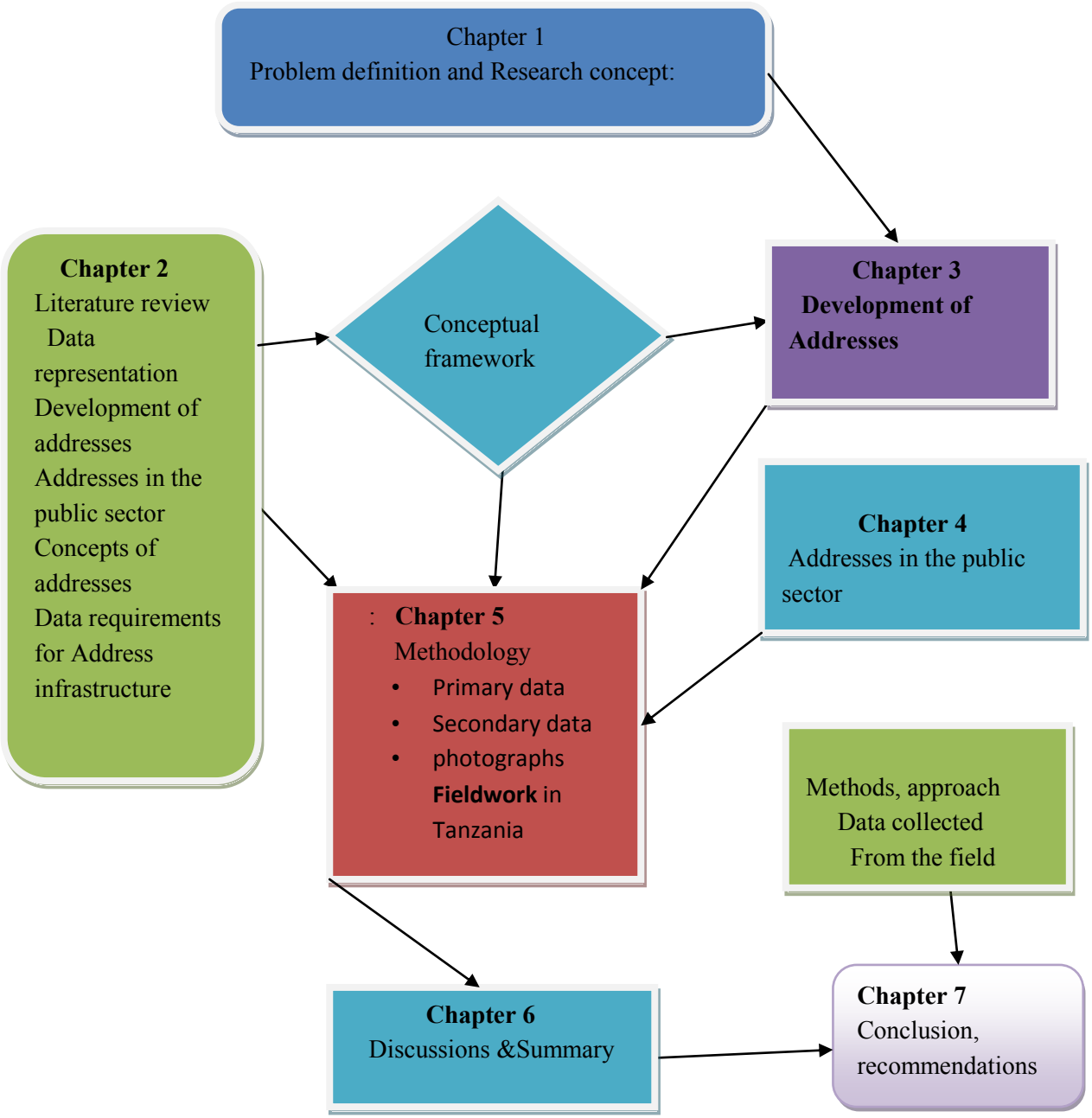
Statement of particulars in the case of a firm

Pursuant to Section 6

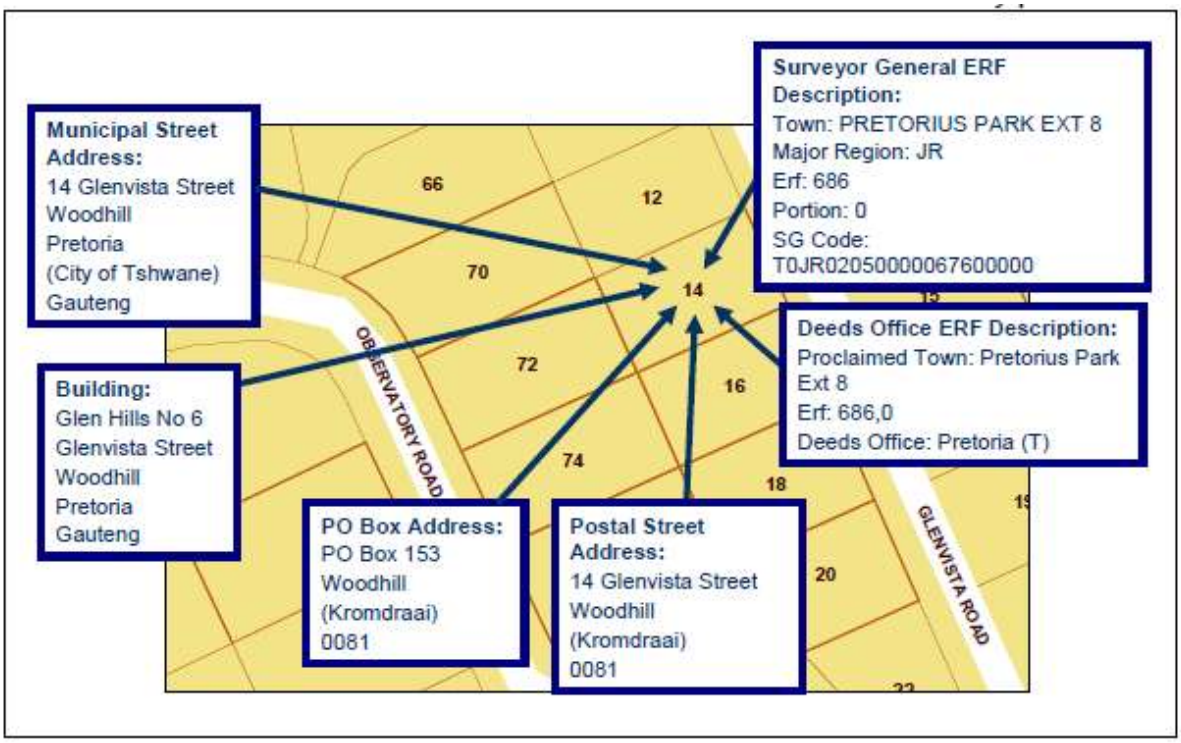
18/9/09

	PREMIUM CONSULTANTS
	CONSULTANCY SERVICES
	UJAMAA STREET HSE No: 65 BLOCK D CHANGOMBE
	1. SWALEHE S. FALAHANI 2. MUSSA NNAMYE 3. HOTT, ABDALLAH
	N/A
	TANZANIANS

Appendix 16 research Procedures



Appendix 17 Sample of many addresses pointing to the same object



Appendix 18 Organizations visited during fieldwork

ORGANIZATIONS	PERSONS TO BE INTERVIEWED
Department of Survey and Mapping	Director, management staff (5)
Department of Land and Human Settlement	Head of land, management staff (8)
Tanzania Fire Service Department	Chief Fire Officer (1)
National Bureaus of Statistic	Chief Field Controller
Tanzania Police Force headquarters	Commissioner of Police
National Housing Corporation	Director , management staff (6)
Municipalities(Kinondoni, Ilala, Temeke)	Chairmen and Senior Supervisors (7)
Dar es Salam Water and Sewage Corporation	General Manager(1)
Tanzania communication Regulatory Agency	Registrar(1),and some management staff(2)
Tanzania postal Corporation	Postmaster general(1) other senior staff(3)
Tanzania Electricity Supply Corporation	General Manager and Senior Staff(4)
Business Registration and Licensing Authority	Chief Executive Officer(1)

Appendix 19 research Methodology

Research Questions	Literature Review	Fieldwork (interviews& Observations)	Qualitative(analysis& interpretations	Discussions ,Conclusion &Recommendations
1	✓	✓		✓
2	✓	✓	✓	✓
3	✓	✓	✓	✓
4	✓	✓	✓	✓

Appendix 20 Research Time Table

Time / Activity	Aug 2009	Sep 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010
Literature Review	✓	✓	✓	✓	✓	✓	✓
Preparation of Research Proposal	✓	✓					
Presentation of research proposal	✓	✓					
Methodology/Fieldwork	✓	✓	✓				
interpretation & analysis of fieldwork				✓	✓	✓	
Mid-Term Presentation				✓			
Recommendation & Conclusion						✓	
Report Preparation& Submission	✓	✓	✓	✓	✓	✓	✓
Thesis Defence							✓