# DEVELOPMENT OF CADASTRAL INFORMATION SYSTEM FOR MAMMY SETTLEMENT, TAKUM LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA

**BY**

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN GIS AND REMOTE SENSING**

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## DECLARATION

I declare that the work in this thesis entitled "DEVELOPMENT OF CADASTRAL INFORMATION SYSTEM FOR MAMMY SETTLEMENT, TAKUM LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA" has been carried out by me in the Department of Geography. The information derived from the literature has been dully acknowledged in the text and a list of references provided. No part of this project work was previously presented for another degree at this or any other Institution.

**Iranyang ALEXANDER** _____ _____

Sign Date

## CERTIFICATION

This thesis entitled "DEVELOPMENT OF CADASTRAL INFORMATION SYSTEM FOR MAMMY SETTLEMENT, TAKUM LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA", by Iranyang Alexander meets the regulations governing the award of the degree of Master of Science (GIS and Remote Sensing) of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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**ABSTRACT**

The aim of this research is to develop a cadastral information system for Mammy settlement. The cadastral layout of the study area was acquired, scanned, georeferenced and digitised using ArcGIS 10.1 software package. In order to obtain the land ownership information, the administration of adjudication form was carried out. A cadastral database encompassing a spatial database and attribute database were then designed and built using the information gathered. Data querying was carried out, the results revealed that, there were 738 parcels and 653 parcel owners in which vast majority of the land owners were males with the proportion of 86.68%. About 46.09% of the parcel owners in the area were civil servants. About 58% of all the parcels were undeveloped. Findings also showed that residential land uses had the highest proportion (58%) while the parcels used for institutional purpose and also mixed purposes had the lowest proportion each covering 3% of the total land uses. The study also showed that, there was high level lack of compliance of land uses and road networks with the layout plan of the area. The following recommendation was suggested: The State Government should employ GIS technology in creating Cadastral Information System in the State to enhance effective and efficient cadastral management.

## TABLE OF CONTENTS

Title Page..... i

Declaration.....ii

Certification..... iii

Acknowledgement.....iv

Abstract.....v

Table of content….....vii

List of Tables…….……x

List of Figures.....xi

**CHAPTER ONE: INTRODUCTION**

1.1 Background to the Study.....1

1.2 Statement of the Research Problem.....4

1.3 Aim and Objectives of the Study.....6

1.4 Scope of the Study.....6

1.5 Justification and Significance of the Study.....6

**CHAPTER TWO: CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW**

2.1 Introduction……...……...…..9

2.2 Conceptual Framework…….....9

2.2.1 Concept of Land.....9

2.2.2 Land Administration…….....10

2.2.3 Land Registration …….....11

2.2.4 Adjudication……12

2.2.5 Land Tenure.....12

2.2.6 Right of Occupancy:…….....13

2.2.7 Concept of Cadastre…….....15

2.2.8 Cadastral Information System…….....17

2.3 Literature Review…….……..18

2.3.1 Cadastral Information Systems and Sustainable Development……..…...…18

2.3.2 The Problems of the Cadastral Map …….....18

2.3.3 The Importance of a Computerized Cadastral …….....19

2.3.4 Reforms in Land Registration and Cadastral Mapping in Nigeria …….....20

2.3.5 The National Cadastral Mapping Programme ……..21

2.3.6 Cadastral and Land Registration in Taraba State.....21

2.3.8 Empirical Studies.....22

**CHAPTER FOUR: THE STUDY AREA AND METHODOLOGY**

3.1 Introduction……..26

3.2 The Study Area.....26

3.2.1 Location.....26

3.2.2 Climate…….....28

3.2.3 Vegetation.....28

3.2.4 Population and People.....28

3.2.5 Social-Economic Activities……..……29

3.2.6 Land Use Pattern…….……..…29

3.3. Methodology.....30

3.3.1 Reconnaissance Survey……30

3.3.2 Types and Sources of Data Used……30

3.3.3 Methods and Techniques of Data Collection……32

3.3.4 Data Processing……32

3.3.5 Creation of Database for Digital Cadastre……33

3.3.6 Method of Data Analysis……36

**CHAPTER FOUR: RESULTS AND DISCUSSION**

4.1 Introduction……38

4.2 Mapping Existing Parcels in the Area……38

4.3 Extent of Compliance to the Original Layout Plan……40

4.3.1 Road Network Compliance……40

4.3.2 Parcel Uses Compliance……43

4.4 Existing Land Owners and their classifications……48

4.4.1 Existing Land Owners……48

4.4.2 Classification of Land Owners……48

4.5 Categories of Parcels ……51

4.5.1 Parcels Status……52

4.5.2 Right of Occupancy ……54

4.5.3 Classification of Parcels Based on Uses……55

4.5.4 Year of Land Purchase……60

**CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION**

5.1 Summary of Findings……61

5.2 Contributions to Knowledge……62

5.3 Conclusion ……...……62

5.4 Recommendations……..…..62

5.5 Suggestion……...……...……..63

**REFERENCES.....64**

**APPENDICES …….....69**

## LIST OF TABLES

Table 4.1: Road Network Compliance……..…..40

Table 4.2: Proposed Parcel Use……43

Table 4.3: Existing Parcel Use…….……44

Table 4.4: Gender of Land Owners……..…49

Table 4.5: Occupations of Land Owners……..50

Table 4.7: Parcel Status…….....52

Table 4.8: Right of Occupancy…….54

Table 4.9: land Use of Mammy Settlement…….……..…….....57

Table 4.10: Years of Land Purchase……60

## LIST OF FIGURES

Figure 2.1 Land Administrations.....11

Figure 3.1: Geographical Location of Study Area (Mammy Settlement)……..…..……27

Figure 3.2: The workflow Chart of the Methodology for the Project.…….....31

Figure 3.3: Entity Relational Diagram of a Parcel-Based Information System…..…..35

Figure 4.1: Existing Parcels in Mammy Settlement…….....39

Figure 4.2: Road Network Compliance…….,,……..42

Figure 4.3a Existing Parcel Use……...……..…..45

Figure 4.3b Proposed Parcel Use……..……..……46

Figure 4.4: Parcel Status…….....53

Figure 4.5: Land Use Map of Mammy Settlement.....56

# CHAPTER ONE

# INTRODUCTION

## 1.1 BACKGROUND TO THE STUDY

Most human activities and developmental efforts are based on land. Therefore, a systematic record of land and rights in land are vital for public administration, planning, land development and private land transactions. This realization led to the involvement of Information Technology (IT) tools, to assist in the creation, documentation, and management of land titles (Dale and Mclaughlin, 1988).

Land is a great resource and indeed, the backbone of wealth in many communities, whether urban or rural. People depend on land for food, shelter, employment, resource, cultural and religious needs. Land is the foundation of all human activities. The relationship between people and land is fundamental to human existence (United Nations Economic Commission for Europe (UNECE), 2005). Issues of land have been identified to be a cause of civil and international wars and even genocide, For example, the Palestinians' struggle for the return of their homeland, the Zapatista movement in Mexico, the Bakassi peninsula land dispute between Nigeria and Cameroon, Movement for the Emacipation of the Niger-Delta, and many other conflicts involved land. Conflicts over ownership, land grabs, social disharmony, reductions in yields, diminished food security, weak land markets and negative impacts on the environment are associated with regions that have poor system of land information management (McLaren, 2011). Current and reliable land information in terms of ownership, land use and value is necessary for: ensuring the security of property rights, reduction in litigation and less work for the courts, better information base for planning and administration, easier transactions in land, less corruption in land affairs and update the land information (Kabir, 2009). The cadastre is the core component of land information management (Anderson, 1989).

Cadastral or parcel-based information system is a general systematic and up-to-date register containing information about land parcel including details of the area, values, use and ownership (Dale 1991). It can also be referred to as involving the acquisition and assembly of data, their processing, analysis and dissemination and use of land information in a systematic manner (Dale and McLaughlin 1989). It is a system of records or inventory of ownership and interest in land parcels supposed to provide statistics of all issues relating to ownership, use and status of landed property in a given geographical area (Dale, 1976). The American Congress on Surveying and Mapping (ACSM) in 1972 defined cadastre as an official register of real estate used in apportioning taxes, while according to Zeimann (1975) it is a complete and up-to-date official register or inventory of land parcels, containing ownership, location, area and land use information while on the other hand, a land parcel refers to an area of land which may be identified as a unit for information recording such as residential plot of land. All these definitions point to the fact that land ownership information is an important mandate of a cadastre.

Williamson and Ting (1999) identified three forms of cadastre as: the fiscal cadastre (used for generating revenue through taxation); legal or judicial cadastre (used for protecting property ownership rights) and; multi-purpose cadastre (combining both functions of the fiscal and legal cadastres as well as being used for utility management, planning, and environmental management, among others).

Cadastral mapping could be described as the process and methods of building of information on land. Traditionally, cadastres and cadastral mapping systems have been manual and paper-based (Borzacchiello and Craglia, 2012). They contain a numerical/diagrammatic description (a graphical description of land parcels) and a separate list of land register containing a list of names and rights of land holder (Zevenbergen, 2002).

In the recent past, manual procedure and methods of data processing were not able to meet the pressure of demand but, with the advent of Geographical Information System (GIS)

which is based on designing and creating database management system, the burden becomes lessened. GIS helps in the creation of more flexible cadastral in an interactive system that allows for the storage of large volumes of data, manipulation and retrieval at relatively lesser time and cost. With GIS therefore, cadastral management becomes less tedious and disregards analogue equipment. More details, which are hitherto reduced with the use of graphical format information, are now clearly shown. It is faster, easy and time-saving. (Raghunath, 2006)

The cadastre which had been in analogue form is not left behind as it is still vital in the development of digital cadastres and cadastral mapping systems allowing the map and the register to be integrated into one single system (a digital cadastral map (database) (Sutherland and Nichols, 2002). Remote Sensing and Geographic information systems (GIS) have therefore become important geometric tools for building of digital cadastral systems (Albert, Edmund, Merem, and Yaw, 2006). Elayachi and Semlali (2001) noted that a digital cadastral map is not a map in the traditional sense, but a map in which attributes (tabular) and map (graphic) data on cadastral unit are stored in the same database. The authors added that a digital cadastral map registers each parcel and its owners and describes all the spatial structures consisting of location, boundaries and contents.

According to Usman (2010), population growth and economic development in Nigeria have created an exponential increase in the demand for land for various purposes. Consequently, the information requirements for land title administrations have increased. Yet the system of information collation and retrieval has remained in most cases unchanged leading to haphazard development of land resources with serious legal, planning, economic, and environmental impacts. Only a few States in Nigeria such as Lagos, Kano and the Federal Capital Territory have computerized land information (Bell, 2011). A greater part of the land in Northern Nigeria is held under a customary system without being covered by cadastral mapping and land title registration (Usman, 2010).

Due to increasing population growth in Mammy settlement, there is currently high pressure on land resources in the area, which urgently calls for the effective management of the resource. The Taraba State Bureau for Lands and Survey charged with the allocation and management of lands in the State is yet to fully incorporate digital method of data management. This makes data storage, update, retrieval and processing extremely difficult (Taraba State Bureau for Land and Survey, 2016). These issues impede decision making in land related matters in the State.

Consequently, there are prevailing litigations and disputes over land ownership as well as poor land development. Decision makers and the public do not have sufficient land information to ensure security of land tenure and bring about sustainable development (Taraba State Bureau for Land and Survey (TSBLS), 2016). Hence the need for this study to develop a cadastral information system for Mammy settlement.

## 1.2 STATEMENT OF THE RESEARCH PROBLEM

De Soto (2002) observed that two thirds of the worlds' land is characterized by bad titling, where titling is neither related to maps and registries, nor backed by the law or plugged into the financial system. According to the United Nations Economic Commission for Africa (2009), decision makers in Africa are not obtaining adequate information from their present cadastral and Land Information Management Systems to make informed decisions as about 90% of land in Africa is not mapped with only less than 1 per cent of sub-Saharan Africa being covered by any kind of cadastral survey and mapping.

Like most African countries, Nigeria still lacks basic maps needed for judicious resource planning, development, and management. Consequently, only about 3% of land in Nigeria is mapped, titled and registered (Ukaejiofo, 2009). Cadastral mapping and land registration only cover a few urban areas. Even in the few urban areas, records are mostly kept in a manual and analogue form. The traditional method of data management has proved to be inefficient and cumbersome. It is faced with problems such as redundancy (the

unnecessary repetition or duplication of data), high maintenance costs, difficulties in moving from one system to another, difficulties in data sharing, lack of security and standard, lack of coherent corporate views of data management among others (Bell, 2011). The existing analogue (paper) maps are unable to show more details and do not allow integration with other datasets which could be achieved by a GIS-Based Cadastral Map (Adeniyi, 2013). In other word, the introduction of Cadastral Information System (CIS) can obviate most of the disadvantages of the traditional method of keeping land records.

The layout plan and records of Mammy settlement are in analogue format over the decades. Updating the records of the area in this analogue format is relatively expensive and time consuming. Also, the decision makers and the public do not have sufficient land information to ensure security of land tenure and bring about sustainable development. Consequently, there have been prevailing litigations and disputes over land ownership as well as poor land development in the study area. There is little or no flexibility in handling the information of the area in this analogue format. Therefore the best way to minimize these enormous problems is the comprehensive application of Geographic Information System (GIS) in plan production and record keeping in order to facilitate its future updating with modern technique. Hence, the creation of digital cadastre in Mammy settlement.

Few studies carried out on the development on cadastral information system in Nigeria are the the work of Bala (2011), Babalola and Kardam (2012) and Wulga (2014)

Studies have been carried out on development of cadastral information system in Nigeria, however, none of these studies was carried out in Mammy settlement, Takum L.G.A. of Taraba State and secondly none of the studies assayed to examine the changes in land uses as earmarked in the proposed layout plan. It is against these backdrops that this study was designed to use Remote Sensing and GIS in developing a Cadastral Information System in the study area towards improving land tenure security. The following are the research questions:

1. What are the existing parcels of land in the study area?
2. Who are the existing land owners in the study are?
3. What are the categories of the parcels of land and land owners in the study area?
4. What is the extent of compliance of roads and parcels use with the proposed layout plan in the study area?

## 1.3 AIM AND OBJECTIVES OF THE STUDY

The aim of the research is to develop a cadastral information system in Mammy Settlement, Takum Local Government Area, Taraba State. The specific objectives are to:

i. identify and map the existing land parcels in the study area.
ii. identify and categories the existing land owners in the study area.
iii. examine the categories of the land parcels in the study area.
iv. understanding the extent of compliance of roads and parcels use with the proposed layout plan in the study area.

## 1.4 SCOPE OF THE STUDY

The spatial scope of the study is limited to Mammy settlement, Takum Local Government Area of Taraba State, this covers areas like: Mammy Market, NTA Axis, Sam Tsokwa Street, Ikam, Langtang Street, Calypso Street, Water Point One and Water Point Two areas. The content extent of the research is to develop a cadastral information system which will cover the identification of land owners, the generation of cadastral geodatabase, and the categorisation of lands and their owners in the study area. The temporal scope of this study shall cover the parcels of lands as at 2016.

## 1.5 JUSTIFICATION FOR THE STUDY

An efficient land tenure management requires an efficient system of cadastral mapping and land registration (United Nations, 1996). Manual land record keeping in Nigeria

has been identified to be the major factor making land administration and management inefficient, daunting, time-consuming and prone to abuses. The present state of haphazard physical development, land tenure insecurity, conflicts and litigation over land in the study area is not unconnected to lack of documented record of land ownership and use. (TSBLS, 2016).

Decision makers do not have adequate land information to make informed decisions in carrying out developmental projects and citing utilities. In other words, the manual system of land administration and management is fraught with a lot of flaws, such as mistake in total number of parcels, difficulty in tracing a file, it is ineffective as it encourages fraud, omission, discrepancies, and not easily updateable (Uluocha, 2012).

This stud provides a digital cadastral database which record land ownership, land use and other related information which brings about security of tenure and in turn ensure social stability, economic development and environmental management. It therefore provides the relevant Ministries responsible for processing of land title documents with the necessary information that could lead to the formalization and issuance of land title documents (Certificate of Occupancy) to land owners in the study area which ensures the security and certainty of land rights. Moreover it among others; reduce disputes on land ownership; form the basis for an efficient property tax system; support the effort of Presidential Technical Committee on Land Reform aimed at registering all rural lands in Nigeria and support the achievement of the Millennium Development Goal, Eradicating Poverty and Hunger, through secured land in rural areas.

Many human activities are related to land. Public knowledge about ownership of land provides legal protection and security. A computer-based land administration system forces standardization in the collation and processing of land data; decrease the cost and space required for storing records; prevent unnecessary duplication; facilitate access to land related data; improve information distribution, reduce the time and cost involved in transferring

property rights, processing mortgages, facilitates the monitoring and analysis of market and rental value of land and property. Therefore, a systematic record and rational use of the land should be of prime importance to planners and policy makers.

Finally, this study will serve as data for further academic research or otherwise and also a baseline data to be utilized by Government and non-governmental organisations.

# CHAPTER TWO

# CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

## 2.1 INTRODUCTION

The purpose of this chapter is to review the literatures related to the research especially in Nigeria. Careful study and review of these works by various authors broaden knowledge of the various approaches to the creation of digital cadastre. The chapter presents a brief description of the concept of Land, land registration, land administration, land tenure, right of occupancy, adjudication, cadastre, cadastral information system, cadastral map, information system, and cadastre in Taraba State and Nigeria.

## 2.2 CONCEPTUAL FRAMEWORK

### 2.2.1 Concept of Land

According to Dale and Mclaughlin (1998), land forms the basis for all forms of human activity, from it we obtain the food we eat, the shelter we need, the space to work and the room we relax. The usefulness of land is enormous; therefore man has to guard it jealously considering its scarce nature. For this reason, conflicts most often arise in the sharing of resources or right of ownership of the land. This of course, is due to the rapid population growth of man on earth and his desires to explore land in myriad of ways

Land is a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface including those of the near-surface, climate, the soil and terrain forms, the surface hydrology (including shallow lakes, rivers, marshes, and swamps), the near-surface sedimentary layers and associated groundwater reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity (FAO, 1995).

### 2.2.2 Land Administration

In a broad sense, land administration is defined as an operational system designed to implement land policies. The UN (1996) defines land administration as "the process of determining (sometimes known as the adjudication), recording, and disseminating information about ownership, value and use of land when implementing land policies."

Land administration serves a number of broad social objectives (e.g. to effect a more equitable distribution of resources); economic objectives (e.g. to foster economic growth by using resources more effectively and to generate revenue); environmental objectives (e.g. to protect scarce and fragile resources); and political objectives (e.g. to connect government more closely to its citizens). The sub-system of information management integrates the outputs of all the other subsystems. It provides the link within land administration sub-systems through sharing and disseminating information. As such, land administration is affected directly and indirectly by policies, laws and organisational arrangements (Barry 1999).

The processes of land administration include the transfer of rights in land from one party to another through sale, lease, loan, gift and inheritance; the regulating of land and property development; the use and conservation of the land; the gathering of revenues from the land through sales, leasing, and taxation; and the resolving of conflicts concerning the ownership and the use of land. Land administration functions may be divided into four components: Juridical, regulatory, fiscal, and information management. These functions of land administration may be organized in terms of agencies responsible for surveying and mapping, land registration, and land valuation (Dale & McLaughlin 1999).

Land administration, according to Barry (1999), is depicted in Figure 2.1. The Figure depicts the relationship between a sample of systems that land administration supports and policies at a higher level in the hierarchy. It is envisaged that each of the sub-systems of land administration (e.g. transportation) represented in figure 2.1 is handled by one or more

different institutions. These operational systems and the emergent properties of each may support a number of different land related policies. For example, the subsystems of land administration depicted in the Figure, each serve their own core strategic objectives, but it is suggested that they are each connected to each other in some way. For example, planning the supply of utilities is likely to depend on accurate cadastral information and also in building a new street in a transportation network (transportation subsystem), it requires cadastral information to identify land parcels to be expropriated, affected land owners (tenure subsystem), and values of these parcels (fiscal subsystem).




**Figure 2.1 Land Administrations (Barry, 1999)**

### 2.2.3 Land Registration

Land registration is the process of official recording of rights in the land through deeds or title (on properties). It means that there is an official record (the land register) of right on land or deed concerning changes in the legal situation or defined units of land. It gives an answer to the question "who" and "how" (Zevenbergen, 2004).

Land registration is the process of recording, and in some countries guaranteeing, information about the ownership of land either through the storage of contract documents about the land (deeds registration) or by compiling special inventories of land ownership (title registration). The function of land registration is to provide a safe and certain foundation for the acquisition, enjoyment, and disposal of rights in land (Larsson 1991). The register of legal property information is often termed the Land Registry or the Germanic term "Grundbuch" (land book). This land register records the ownership, legal rights, restrictions and responsibilities relating to each individual land parcel.

### 2.2.4Adjudication

Adjudication, according to Lawrence (1985), is the process of determining rights in a land unit (i.e. a parcel, or in more general sense, a physical space). Adjudication is often referred to as first registration or land titling, which involves the initial compilation of the land register. According to Dale and McLaughlin (1999), adjudication is the formalization of unwritten evidence of ownership into sworn written statement to be legally recognized as a documentary proof of ownership. It is the procedure to formalize land through land rights identification, demarcation, cadastral surveying and mapping (Zevenberngen, 2001)

In certain cases of cadastral reform conversion from the 'old' to the 'new' system may be applied. But when virtually no written documentation is available, a careful procedure is necessary to inventory all relevant interests that exist and should be entered in the register. This process is called 'adjudication'. During adjudication particulars of all rights and liabilities in a parcel must be ascertained and determined conclusively (Larsson 1991, p.101).

### 2.2.5 Land Tenure

A definition of land tenure is provided by Barry and Fourie in (2002) as the way in which land is defined and held. An analogous definition is presented by Van (2002) in which he defines land tenure as the mode in which rights to land are held based on statutory law, common law, and customary traditions. Using the words of Payne in (2001), land tenure is

the mode by which land is held or owned, or the set of relationships among people concerning land or its products. The latter two definitions do not explicitly include the definition of a land object (i.e. how people perceive land) as part of the tenure system. Another aspect of land tenure is the level of recognition (legitimacy) it holds from public authorities. Tenure can be regarded as formal and informal. Formal tenure is usually a legally recognized form of tenure. On the other hand, informal tenure is not necessarily illegal, but it might evolve outside of the formal legal processes in the form of contractual or customary arrangements (Dale and McLaughlin 1988). Therefore, it is possible for informal land tenure to become legally recognised over time (Barry 1999). However, this categorization of tenure systems as formal and informal (or legal and illegal) is very simplistic. In the real world, there are complex situations where a mixture of formal and informal tenure co-exists. Hence, researchers have emphasized the need to view land tenure on a continuum where formal and informal systems are on opposite extremes and other forms of tenure systems reside in between (Barry 1999).

### 2.2.6 Right of Occupancy

The Holder of Right of Occupancy is defined by Section 51 of the Land use Act (LUA) as: A person entitled to a right of occupancy and includes any person to whom a right of occupancy has been validly assigned or has validly passed on the death of a holder but does not include any person to whom a right of occupancy has been sold or transferred without a valid assignment, nor a mortgagee, sub lessee or sub-under lessee, Any person to whom a right of occupancy has been sold or transferred without a valid assignment, means without the consent of the Governor ( Akintunde, 2015).

Right of occupancy by virtue of Sections 5(1) (a) and 6(1) (a) of the Act is classified into statutory and customary rights of occupancy.

*2.2.6.1 Statutory Rights of Occupancy*

The Governor of a State has the exclusive power to grant the right of occupancy in respect to any land in the territory of each state to any person for all purposes ,whether the land is located in an area designated as an urban area or not. This right of occupancy so granted by the Governor is defined as "statutory right of occupancy" under the LUA.

i. Delegation of the Power to grant Statutory Right of Occupancy: The Governor may delegate to a State Commissioner power to grant Statutory Right of Occupancy to any person for all purposes, subject to such restrictions, conditions and qualifications, not being inconsistent with the provisions, or general intendment, of the Act as the Governor may specify. Where the power to grant certificates has been delegated to a State Commissioner such certificates shall be expressed to be granted on behalf of the Governor.

ii. Land Vested in the Federal Government: In respect of land comprised in the Federal Capital Territory or any land held or vested in the Federal Government in any State, the powers to grant rights of occupancy is vested in the President or any minister so designated by him. The right of occupancy so granted is also defined as statutory right of occupancy as in Section 51(2) of the land Use Act. (Akintunde, 2015)

*2.2.6.2 Customary Right of Occupancy*

According to Akintunde, (2015), there are two types of customary right of occupancy, these are:

i. Right of occupancy expressly granted by a Local Government authority - Local Government authorities are vested with the power to grant right of occupancy in respect of land in their localities which are not designated as an urban area by the State Government. The right of occupancy so granted by a Local Government authority is defined as a customary right of occupancy.

ii. Right of occupancy enjoyed by people who hold their title under customary law - It should be noted that, under the Land Use Act, a customary right of occupancy includes the

right of a person or community lawfully using or occupying land in accordance with customary law.

*2.2.6.3 Certificate of Occupancy (C of O)*

A Certificate of Occupancy is granted by State Government as evidence of a statutory right having been granted. It requires survey, and legal registration of title. It will also contain provisions as to length of term, rent payable, type and value of development and conditions for mortgage and sale of unexpired term. A certificate holder is in a much stronger position should his land be require for "Public purposes" since he will be entitle to compensation for the value of the "unexhausted improvements' over the period of this grant, as well as the inconveniencies caused by disturbance (Section 35 Land Tenure Law 1962). The length of term may not exceed 99 years.

### 2.2.7 Concept of Cadastre

The cadastre is most simply described as a methodically arranged public inventory of data concerning properties within a jurisdiction, based on a survey of their boundaries (Henssen 1995). From a database perspective, this is a land information system where information is referenced to unique, well-defined units of land, normally referred to as land parcels. The outlines of these land parcels are normally shown on large scale maps, are linked to textual land title registers and provide a spatial reference for other spatial or aspatial, parcel related data.

A cadastre is similar to a land register in that it contains a set of records about land. A cadastre is an information system consisting of two parts, a series of maps or plans showing the size and location of all land parcels, together with text records that describe the attributes of the land. It may be based on the proprietary land parcel (the juridical cadastre), that is the area defined by ownership; or on the taxable area of land (the fiscal cadastre); or the extent of particular activities on the land (the land use cadastre) (Williamson 1996). The type of boundaries recorded on cadastral maps will depend on the definition of the cadastre. A

cadastre is distinguished from a land registration system in that the latter has been exclusively concerned with ownership. A land register must operate within a strict legal framework and may not, in practice, cover a whole country since not all citizens may choose to register their lands. The cadastre, however, should be based on complete coverage of a country since it may be used for the purposes of land taxation. Where the information within a cadastre is based on the proprietary unit, but encompasses both fiscal and land use data, the term multipurpose cadastre is often used. Once computerised, all forms of the cadastre are land information systems (LIS), a term that is applied to systems that manage a wide range of spatial information including environmental and socioeconomic data as well as data related to utility infrastructure systems. A land information system is not necessarily land parcel based and may be restricted in its thematic content and in the extent of area covered. The term cadastre tends to refer to the actual cadastral data, whereas the cadastral system is additionally the collection of organisations (people) and procedures that are associated with the cadastral data.

The evolution of the cadastre dated back to 3000 BC where the Romans recorded information about their controlled land for a basic of fiscal records (Larrson, 1991). It was not until the 1870s, when Napolean Bonaparte established the first modern cadastral system. He ordered the creations of maps and cadastral records that eventually established the foundation of the European cadastre. In the 18th and 19th century, the cadastre was used in Continental Europe for taxation and fiscal purposes (Williamson, 1985). Since then, cadastral systems have been used as an important tool for urban planning and service delivery. As taxes evolved over time into complex differential tax-assessment, so did the cadastre to support other land-related arrangements

In Australia, the cadastral map has gained the most attention, as massive data migration of many Australian state owned cadastral databases was seen in the 1980s, with the first introduction of the Digital Cadastral Databases (DCDB) that represents the traditional

cadastre in a digital form. In Victoria, a pioneer move to develop the DCDB was spearheaded by the Land Title's Office through the LANDATA project in 1984 (Williamson *et al.*, 1998).

### 2.2.8 Cadastral Information System

Cadastral or parcel-based information system is a general systematic and up-to-date register containing information about land parcel including details of the area, values, use and ownership Dale (1991). This parcel-based and information system otherwise referred to as Cadastral Information System (CIS) has been positively affected by the advancement in computer and space technology and greatly improved methods of information gathering, storage, dissemination. Cadastral information system is a sub-set of Geographic Information System (GIS), which is concerned with the provision of spatially reference data, (Didigwu and Olakanmi, 2016). It can also be referred to as involving the acquisition and assembly of data, their processing, analysis and dissemination and use of land information in a systematic manner (Dale and McLaughlin 1989).

The task of any Cadastral Information System (CIS) is to register in a condensed manner ownership, rights and other relationship between man and land (Didigwu and Olakanmi, 2016). Every country considers the protection of the land parcel and rights to land to be a government task. Cadastral systems play a key role on this respect (Zevenbergen, 2001). Though it requires huge amount of financial support in maintaining CIS, the authentic and electronic copy of record will aid in keeping up-to-data information about land.

The usefulness of such a system will depend upon up-to-datedness, accuracy, completeness, and accessibility, and also upon the extent to which the system is designed for the benefit of the user rather than for the producer of the information (Dale and Mclaughlin, 1988).

## 2.3 LITRATURE REVIEW

### 2.3.1 Cadastral Information Systems and Sustainable Development

One of the important products of any cadastral system is the cadastral map. But the existing systems consisting of paper maps and conventional land registers are becoming inefficient. For that reason, a Cadastral Information System (CIS), based on digital cadastral map in which attributes and map data on cadastral unit are stored in the same database, should be introduced. In "Digital Cadastral Map: A Multipurpose tool for Sustainable Development", Moha and El Hassane (2001) argued that CIS should be designed to support not only the cadastral mapping or the land surveying and titling but also a variety of purposes such as identifying specific areas, determining limits of different status of land among others. The authors aimed to undertake a research about advantages of digital cadastral map and its uses in implementing a multipurpose cadastral information system for sustainable development. They outlined the possibilities of integrating other systems with digital cadastral map so as to enhance the land planning and management.

### 2.3.2 The Problems of the Cadastral Map

Unlike small to medium scale topographic data sets, cadastral maps are dynamic; they must reflect the daily changes in the cadastral framework arising from land development. The map of the land parcels is therefore never finished, as it must be constantly updated to keep pace with the subdivision, consolidation or mutation of land boundaries and the titling processes associated with land development (Wolfgang, 2001).

These spatial cadastral databases have entered a maintenance phase that involves both updates and upgrades. The incorporation of all changes to the parcel framework, as a result of land development activities such as land subdivision, is referred to as update. Upgrades are corrections, alterations and adjustments to improve the content and accuracy of this spatial cadastral data (Wolfgang, 2001).

In addition to the requirement for an efficient and timely process to keep the cadastral map up to date, there is considerable pressure to increase the accuracy of the cadastral geometry data in line with emerging surveying technology. The ever improving accuracy of new information (new surveys) with respect to current digital cadastral maps, means that more accurate spatial data must be incorporated into the existing cadastral maps that are often of a much lower spatial accuracy and reliability (Henssen, 1995).

### 2.3.3 The Importance of a Computerized Cadastral

The main advantages of computerization of cadastral are:-

i. Speed up the collection and processing of cadastral survey data.
ii. Make significant reductions in the cost and space required for storing and retrieving land records.
iii. Prevent unnecessary duplication of records.
iv. Simplify the preparation of "back-up" copies of registers in case of disaster. Accelerate the processing of data for the first registration of title.
v. Reduce the time and cost involved in transferring property rights and in processing mortgages.
vi. Facilitate the monitoring and analysis of land and property.
vii. Provide better estimates of the value of land for taxation or compulsory acquisition
viii. Improve efficiency and effectiveness in collecting land and property taxes.
ix. Assist the compilation of information and reports that were impossible or very cumbersome to produce using manual systems.
x. Provide mechanisms for quality control.
xi. Integrate the records of land ownership, land use and land value with socio-economic and environmental data in support of physical planning.
xii. Assist in the allocation and monitoring permits to build on land.
xiii. Manage property assets and ensure their efficient use and maintenance.

xiv. Record tree preservation orders and conservation areas.

xv. Support the management of utilities such as water, sewerage, gas, electricity, street lights, and telephones (Raghunath, 2006).

### 2.3.4 Reforms in Land Registration and Cadastral Mapping in Nigeria

Oboli and Akpoyoware (2010) noted that some level of modernisation and reforms are on-going in some states in Nigeria to ensure effective and more efficient administration of the land to bring it to optimum use and benefits. Throughout the nation, at Federal and state levels as well as in the Federal Capital Territory various steps have been taken to improve Surveying and Land administration. At the Federal level, the Federal Land Information System (FELIS) has been set up to facilitate land transactions and administration while Abuja Geographic Information System (AGIS) was introduced in the Federal Capital Territory (Abuja) under an electronic data capture scheme expected to assist in conflict resolution in plot allocation and innovation in land registration. In Lagos State attention is being paid to registration of Land titles, business enterprise identification while standardization was given high priority. Other states that have taken a bold leap forward to modernize land administration include Ogun, Benue, Anambra, Kano, Ondo, Cross River, Enugu and Delta.

### 2.3.5 The National Cadastral Mapping Programme

The Survey Unit of the defunct Federal Ministry of Housing and Urban Development in collaboration with the Office of the Surveyor General of the Federation (OSGOF) proposed a Large Scale Cadastral and Township Mapping Programme for Nigeria in 2005 (Oboli and Akpoyoware, 2010). Furthermore, the Minister of Housing and Urban Development at the time made a presentation on the progress of FELIS in year 2006 to the Federal Executive Council (FEC) which resulted in Mr President setting up a Cabinet committee, and eventually the Cabinet Committee was assigned the task of proposing a programme for the implementation of a Comprehensive Computerisation and Modernisation of Land Administration in Nigeria as well as a National Cadastral and Township Mapping

Programme. The programme still remains in the planning stage due to funding constraints. The Cadastral and Township Map of Nigeria which would have facilitated the Land Reform and development of Nigeria remains elusive (Oboli and Akpoyoware, 2010).

### 2.3.6 Cadastral and Land Registration in Taraba State

The problems of Cadastral Survey in Taraba State like in most States in Nigeria can be traced to the operation, funding and public perception of the need or its desirability. Funding has a great role to play since it has a direct impact on the mode of operation. There is a distinct lack of dynamic cadastral maps as well as dearth of up-to-date, inadequate logistics, lack of transparency in work processes, delays and cumbersome manual procedures, perceived corruption, and the lack of technical expertise in new technology available.

The low Government budgetary allocation accorded to surveying and mapping has not improved the situation. Manual record keeping is in use by the Bureau for Land and Survey. This is maintained by keeping of records, maps and data in files and cards in analogue format. The files are stored and retrieved by manual tracing.

Though, there are efforts at improving the Cadastre and modernising land administration in some parts of the country. Examples can be seen in Lagos, Kano and Enugu states as well as Abuja, FCT. In Lagos State the Electronic Document Management Systems (EDMS) was launched to provide services in the improved land registry. Most of the records pertaining to titles on landed property for urban lands where documentation exists have been converted to digital format and the Land Registry has completed computerization of its records. In the Federal Capital Territory (FCT) the Abuja Geographic Information System, AGIS was set up in 2004 to serve as a Spatial Data Infrastructure for Abuja. Thus AGIS is expected to assist in conflict resolution in plot allocation and innovation in land registration. On 25th May, 2006 Enugu State commissioned the State's computerized land registry called Enugu State Land Information Management Service (ESLIMS).

### 2.3.7 Empirical Studies

Bala (2011) created an enhanced geospatial information system for Kabama estate, Sabon Gari, Zaria. The researcher succeeded in creating a reliable database for the management of land information in this location. The satellite imagery of the area was acquired, the lay out plan, and its related land parcel records were collected from the ministry of land and survey. The land records were used to create the attribute database in ArcGIS 9.3. The findings revealed that there are 243 plots out of which residential has the highest number with 235 plots, others like Religious, educational, recreational centre, petrol filling station, children play ground, clinic and bank each has just one (1) plot. The total area covered by the study area is 20.25 hectares. Some individuals own more than a plot and most of the plots were owned by civil servants.

Chiemelu and Eze (2011) created a digital cadastre for Bethel Estate, Enugu East Local Government Area, Enugu State. The authors aimed at creating a land administration and management database in order to facilitate an efficient and effective land-use administration in the area. The primary data collected include the coordinates of some pillar numbers obtained with GPS receiver which was used for geo-referencing of the plan, and the attribute data collected during the ground-truthing to confirm the type of buildings present in the site. The secondary data used include analogue plan of the layout, analogue plan of the built survey, coordinates of the boundary pillars, building plan of the site, and attribute of the plots. The analogue layout plan of the estate and the building plan were scanned. Four pillar coordinates were used for the georeferencing of the plans. The attribute data for roads, buildings, land parcels, pillar number and block from the field data were integrated with the base map data. Spatial and attributes database was created, database queries and analyses. The study also include geospatial database queries whereby relevant information from sets of spatial and attribute data were extracted. The results of the queries and analysis show that, 34.6% of the properties were 3 Bedroom Detached Bungalow, 2.6% of the properties had an

area that is greater than 557.479$m^2$, the annual ground rent of 12% of the properties had not been paid, 6 % of the properties were used for commercial purposes, 16.6% of the properties were yet to be sold and 4.6 % of the properties were valued less than N 5, 500:00

Babalola and Kardam (2012) developed a Cadastral Information System for Part of Fadaman-Mada Area of Bauchi Metropolis. The cadastral layout plan of the area of interest, consisting of 60 plots, were integrated and updated with a comprehensive digital map and cadastral data. An accurate digital map of the area was produced which include feature details shown in graphics and tables. Their findings include changes to roads initially designed for dual carriage which were reduced to single lanes; others that were initially closed were extended to intersect the major ones. The study also revealed that plots were further subdivided into smaller or bigger sizes than earlier designed. It was concluded that computer technology plays a vital role in keeping cadastral record by making it possible for information to be kept in different formats.

Orisakwe and Bakari (2013) developed a parcel-based cadastral information system (CIS) of part of Kofare Government Residential Area (GRA) of Jimeta – Yola. Analogue layout plan and the analogue topographical sheet of the study area were acquired, scanned, digitized and Georeferenced in Joint Photographic Expert Group (JPEG) format and imported into AutoCAD 2010 software where it was georeferenced. Parcel, Road and Boundary layers were created in AutoCAD environment. The Arcview 3.2a software was used to polygonize the parcel theme and converted to shapefile. Spatial and Attribute database were created and linked through a linkage mechanism with an identifier number. The database was integrated with some multimedia information. Queries were generated to evaluate and test the efficiency and showcase the efficacy of the CIS system. Findings revealed that female parcel owners constituted 20% of the parcel owners, the indigenes of Adamawa State constituted 90% of the parcel owners, while the indigenes of Yola North Local Government Area made up 7% of the Parcel owners.

Wulga (2014) used Remote Sensing and GIS to develop a digital cadastral Information System for Banjiram, Adamawa State. The methodology involved scanning, geo-referencing and the vectorisation of the layout plan of the study area in ArcGIS 10.1. A remotely-sensed image upon which the digitized parcels were overlaid was presented to land owners to visually identify their land and information about the owners was obtained. A cadastral database was then designed and built using the information gathered. The findings revealed that: there were 1278 parcel with 1166 owners. About 84.977% parcels were allocated while 15.023% parcels were not allocated; there were 67.762% parcels that were developed while 32.238% parcels were not developed. The study also revealed that out of the 1278 parcels 31.91% were found to be used for residential purpose, 20.016% for institutional purpose, 2.431% for commercial purpose, 14.2% for agricultural purpose and 31.408% for mixed uses.

Atanlode (2014) created a digital cadastre for part of Sunshine Estate, Akure South Local Government Area, Ondo State. The ground control point (GCP) UTM Coordinates of some five selected pillars and the analogue cadastral layout were obtained from office of the Surveyor-General, Ondo State Ministry of Lands and Housing, while the attribute data were obtained from the Land Allocation Officer, Ondo State Land Records Bureau. The layout plan of the project area was scanned. The scanned plan was then exported to ArcGIS 9.3 for georeferencing and digitizing. Attribute data were typed manually into the computer and were used for creation of database. These data were processed and manipulated to give useful information. Database query results show that there were total of 72 parcels and 1.4% of these parcels were yet to be allocated. The results show that there were 10 road networks of which 80% of them were unpaved. 88.9% of the parcels were undeveloped while only 11.1% of the remaining parcels were developed. In addition, 9.7 % of the total parcels were owned by females.

Shekwoaga (2016) evaluated the effectiveness of development control in Minna metropolis. The Quick bird and Ikonos satellite imagery of 1 metre resolution was acquired

and digitized to assess the level of compliance to development control. Interview was deployed as a method of data collection to examine factors influencing non-compliance, the enforcement of development control and implication to non-compliance to proposed plan. The findings revealed that 55.1% of the buildings in the study area have encroached into road. The total area coverage of 16.55% hectares has been developed in the area contrary to the layout proposal of 14.44% hectares. Also, further findings revealed that there is decline in space proposed for public facilities and services in the area as just 49.9% of the land uses complied with the proposed plan even though 8.7% of the converted land uses were regularised by the Ministry of Land and Housing, 91.3% did not go through the same process.

# CHAPTER THREE

# THE STUDY AREA AND METHODOLOGY

## 3.1 INTRODUCTION

This chapter of the research describes the geographic variables, population, economic activities in the study area, and the geographical settings of the environment such as the climate and vegetation. Similarly, the data types and sources, tools and procedures for data collection and methods and techniques of data processing were discussed.

## 3.2 THE STUDY AREA

### 3.2.1 Location

Mammy Settlement is located between Latitudes 7°14'N - 7°15'N of the Equator and Longitudes 9°56'E - 9°57'E of the Greenwich meridian (See Fig. 3.1). The area is an extension of Urban Takum to the South West along the Katsina Ala - Takum Federal Highway, adjacent to the Nigerian Army Barracks (Ada Barracks), 5 Km south west of Takum the Local Government Headquarters. In terms of area extent, the study area covers about 120 hectares. This settlement first came about by the establishment of the 93 Army Battalion Ada Barracks in 1962 in Takum Local Government Area, Taraba State which attracted people to settle in Mammy opposite the Army Barracks due to different reasons like security, farming and/or business (Information Unit, Takum L.G.A, 2016)

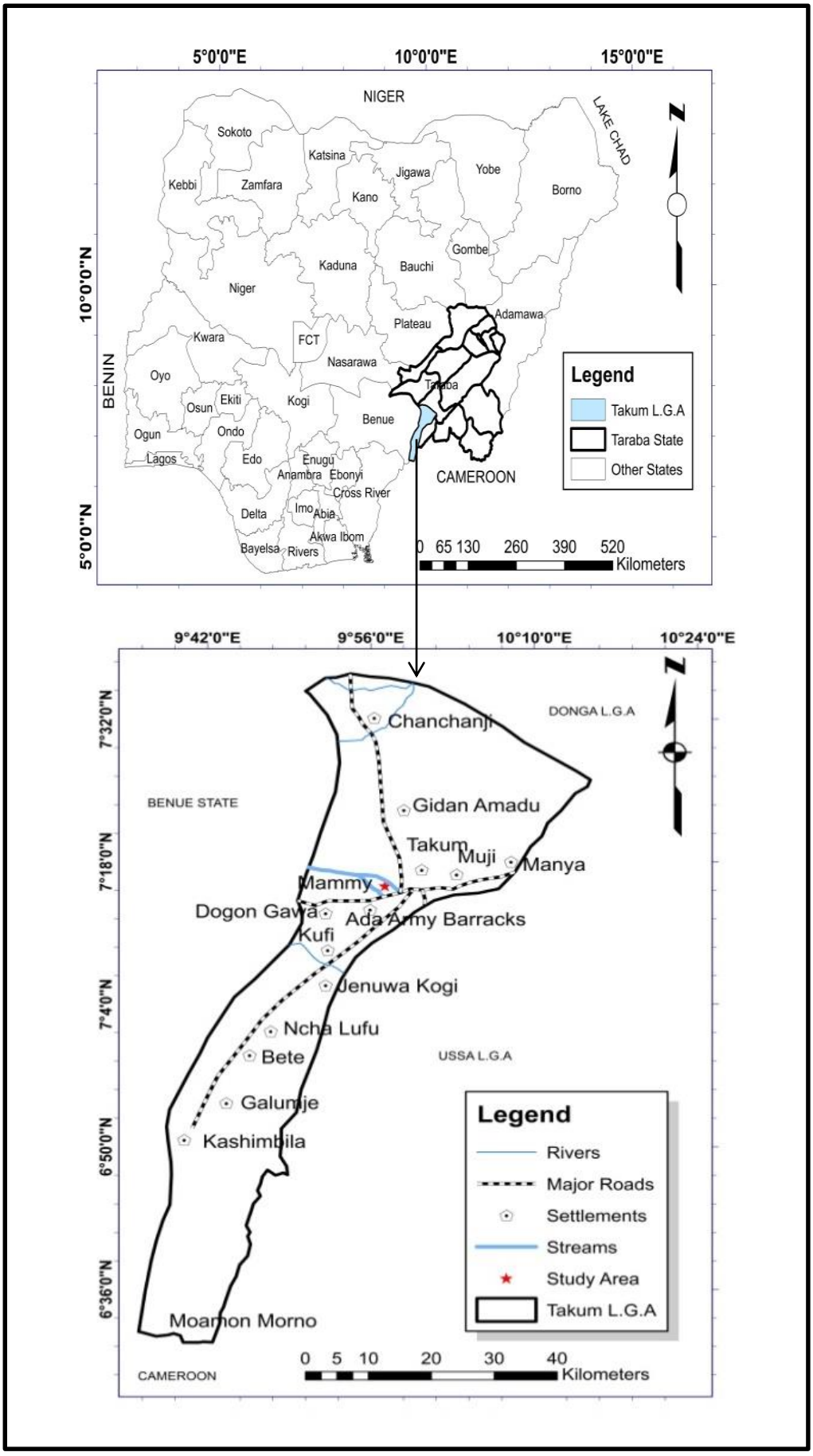



**Figure 3.1: Geographical Location of Study Area (Mammy Settlement)**

**Source: Author's Analysis**

### 3.2.2 Climate

The study area falls within the humid tropical savannah climate based on Koppens classification 'Aw'. It is characterized with two distinct seasons (a wet and a dry seasons) orchestrated by the movement of the inter-tropical convergence wind. The dry season which takes about 4 months in the area begins in early November and last till March. The dry season is linked to the dry tropical continental North easterly winds (Harmattan) a hot, dry, dusty mass blowing from Sahara desert. While the wet season starts from April and end October which lasts for about seven (7) months. The annual rainfall total ranges from 1,200mm to 1,300mm. The wettest months are August and September. The dries months are December and January. The extent of movement of wet maritime air from the Atlantic Ocean inland determines the length of the wet season as the continental air masses retreats further inland. The mean annual temperature is about 28$^{o}$C. The maximum temperature is experienced between March and April while the minimum temperature is experienced between December and January. The relative humidity is over 90% in September and 10% in January (Andesikuteb, 2008).

### 3.2.3 Vegetation

The study area is found within the Southern Guinea Savannah zone of Nigeria with vegetation consisting of woody trees, shrubs and grasses of various heights. The scatter trees are mainly those of economic value and include locust bean, mango, cashew, oil palm, guava, Orange, etc. These trees produce valuable fruits, and wood which can be utilized for small-scale industries. The oil palm is utilized for its palm oil, palm kernel, palm wine, broom sticks and several other products (Rikin 1997).

### 3.2.4 Population and People

According to the data gotten from Nigerian National Population Commission (1991), the population of Mammy Settlement was 2,765. The population of Mammy Settlement in

2016 using the exponential projection formula [$Po = P1 (1+r)^n$ ] of population recommended by the National Population Commission was estimated to be about 6,543 with the Growth rate of 3.5%.

Mammy Settlement is dominated by Kuteb tribe, earlier known as "Ndetirikwen" or "Zompere" a tribe that is believed to have migrated from Egypt into the interior of Africa under a leader called Kuteb in about 1000 BC. They moved into Central Africa and eventually to West Africa through Cameroon and settled on and around the hills of present day Takum. The name "Kuteb" eventually became the name of the tribe and the name of his sons became the names of the clans. Other minority tribes in Mammy Settlement include Tiv, Igbo and few other tribes from other parts of the country (Information Unit, Takum L.G.A, 2016).

### 3.2.5 Social-Economic Activities

Several economic activities are going on within Mammy. Majority of the people engaged in farming with few others in trading and civil service. Some of the farm produces found in the area which serve both as consumer, and producer goods are banana, cassava, fruit, maize, millet, oil palm products, and cereals.

These farm products are mainly produced in small quantity and consumed locally. Others agricultural activities in the area include poultry farming and animal rearing. Other off farm activities which people engaged in are mechanic, carpentry and bricklaying (Rikin 1997).

### 3.2.6 Land Use Pattern

Residences captured larger part of the land use as compared to other land uses. The residences consist of low, medium and high cost residential areas. One other land use is the mixed land use which incorporate both commercial and residential purpose; the buildings are used for both residential purposes and as shops. These land use keep getting converted from

one form to the other most especially from agricultural to residential as a result of the pressure on the land in the area. Agricultural land use is gradually disappearing as a result of urbanization. Few other land uses are Institutional which comprises of the religious institutions (Churches and a Mosque) and Educational Institutions (Primary and Secondary Schools) (State Bureau for Land and Survey, 2016)

## 3.3 METHODOLOGY

This section shows the data used, their sources, the mode of collection as well as how the data was processed and analysed.

### 3.3.1 Reconnaissance Survey

A reconnaissance survey was carried out. The purpose was to get the researcher acquainted with the study area. The Bureau for Lands and Survey was also contacted and the Administrative map and the layout plan Gongola State Town Planning (G.S.T.P 6) of the study area which was designed in the year 1982 were obtained from the Bureau. These helped the researcher to gain insight on issues regarding land parcels in the area. The researcher observed some irregularities such as the conversion of land parcels to road network and vice versa in few locations in the study area and the change in parcel use which is not in compliance with the layout plan.

### 3.3.2 Types and Sources of Data used

Different types and sources of data were used to achieve the desired aim and objectives of this study.

*3.3.2.1 Data Types*

i. Geographic coordinates of selected beacons
ii. List of land owners and ownership information
iii. Google Earth Satellite Imagery at 15m resolution
iv. Layout plan (G.S.T.P 6) at scale of 1:25.000

*3.3.2.2 Sources of Data*

The data used for the study were obtained from the following sources.

i. Global Positioning System (GPS) Survey (Garmin CSX 76) was used to obtain coordinates of the selected beacons.

ii. Administration of Adjudication Form to obtain list of parcel owners and ownership information.

iii. Taraba State Bureau for Lands and Survey to obtain Layout plan.

iv. Seminar papers, journals, thesis, text books and web reference materials to source literature materials.

The research methodology workflow is presented in Fig. 3.2

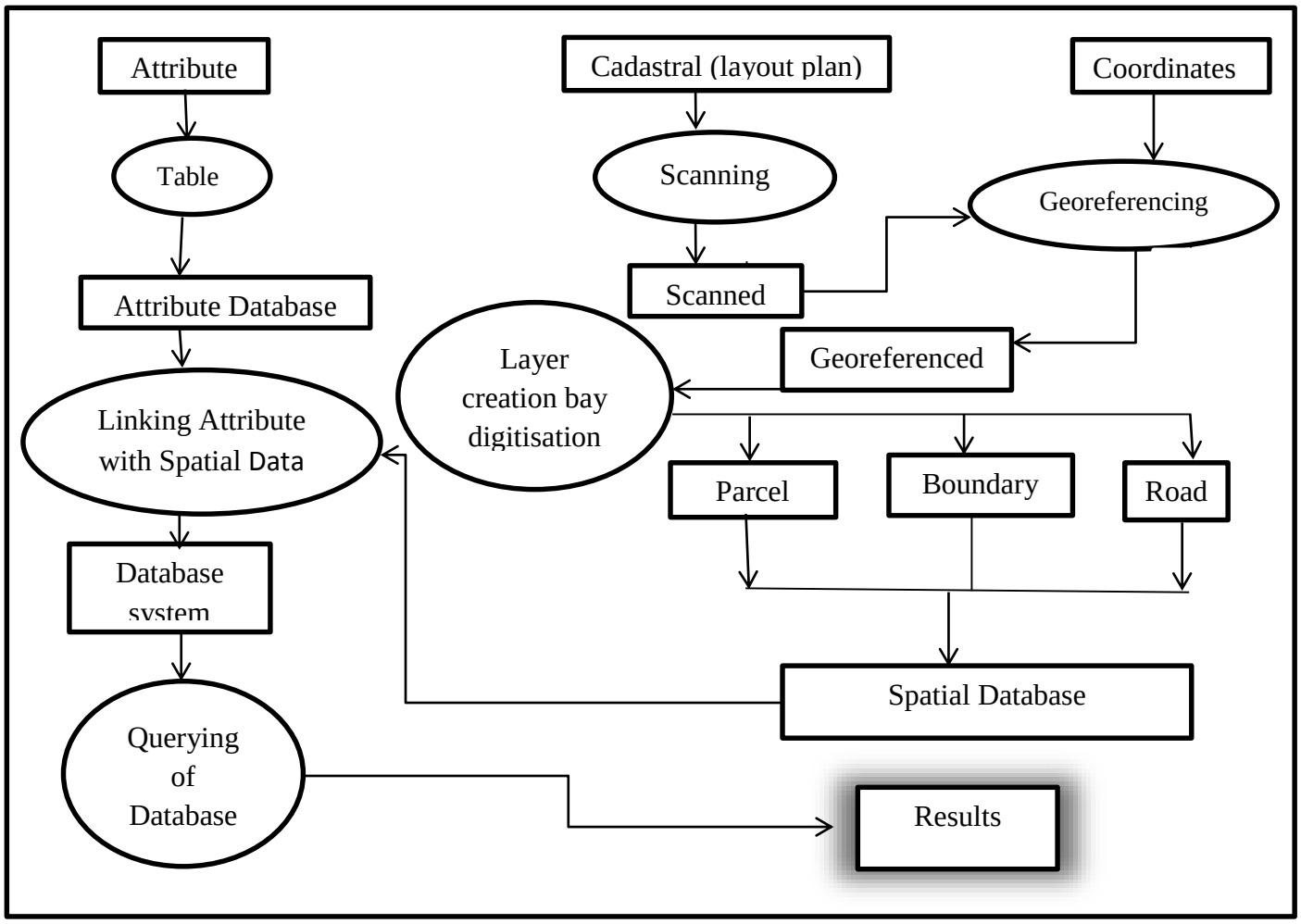



**Figure 3.2: The Workflow Chart of the Methodology for the Project.**

**Source: Modified from Orisakwe and Bakari (2013).**

### 3.3.3 Methods and Techniques of Data Collection

*3.3.3.1 Attribute Data Collection*

Attribute data of parcels and parcel owners such as size of parcels, right of occupancy status, year of purchase of parcels, names of parcel owners, address, among others were collected through field work by the administration of adjudication forms to land owners in order to determine the existing land rights in the study area. Prior to the process, announcements were made in Churches and Mosques within the whole community to sensitize land owners on the exercise and the criteria used to adjudicate land rights. An adjudication form and a hardcopy indexed satellite image/map containing digitized parcels with unique identification numbers was used for ease of identification of parcels by owners. The adjudication exercise involved visits to each parcel where land owners were required to identify their plots on the satellite image on which the scanned, georeferenced and digitised layout plan was overlaid. When the parcel owners identified their parcels and their claims of ownership were verified and authenticated by presenting their land documents, they were required to provide the necessary details to fill the adjudication form. Information such as their names, occupations, sex, States, among others were provided.

### 3.3.4 Data Processing

In order to process the Layout plan, the following processes took place:

*3.3.4.1 Scanning*

Geometric data was acquired by scanning the analogue layout plan of the project site thus converting it to raster data which is suitable for the raster data processing. The image was then imported into ArcGIS 10.1.3 software for georeferencing and digitizing. Ground truthing field check was later carried out to validate the sampled parcels.

*3.3.4.2 Georeferencing*

The first stage carried out in the data processing phase of the study was image georeferencing. The scanned plan was georeferenced in ArcGIS 10.1.3 using the UTM

coordinates of four of the selected points (beacons) in the layout (coordinates of beacons). These were used for the exercise as ground control points (GCP). This positioned the layout plan/map on the Universal Transverse Mercator (UTM) map grid by connecting it to the Minna Datum.

*3.3.4.2 Attribute Data:*

In the case of the attribute data of land owners which was collected through the administration of adjudication forms. A land owner table containing names and other information on land owners as contained in the adjudication form was created directly in ArcGIS.

### 3.3.5 Creation of Database for Digital Cadastre

There are two methods being used for the creation of a digital cadastre- one is the digital capture of data using total station and GPS instruments, the second is the digitization of existing hardcopy map sheets (Carter and Bounhom 2007). The second method for the creation of digital cadastre was employed in this research; it focuses on the conversion of the analogue cadastre to digital form. Thus, the digitization method of data collection or acquisition was adopted.

On importation of the scanned image into ArcGIS and subsequent georeferencing and digitizing, a table was automatically created by the software for the formation of attribute database. This attribute table was then populated with the parcel information obtained from the administration of adjudication form to the land owners. Among the attribute data obtained were the, names of allotee (parcel owner), Size of the Parcels, etc. In ArcGIS, the layout plan was segmented and polygonized through digitizing forming the spatial database.

Fields for feature classes and tables were created based on the design in the physical geodatabase design on Figure 3.3. This was carried out in ArcMap. Some special fields which had domain include: Owner occupation, Owner sex, Ownership right type, owner State (Owners table); and Parcel use, Parcel status, Parcel allocation status and Parcel address

(Parcels feature class). All fields were populated using some of the information obtained from the field and the information derived from the layout plan.

Database implementation is the combination of the geometric and attributes data in creating the database for the purpose of spatial analysis and query (Effiong and Alagbe, 2012). The two databases, spatial and attribute databases were linked together by means of unique identifier number in ArcGIS to form the land information database system for the study area. Following the processing and manipulation of the data and the population of the database, the Digital Cadastre was produced and managed through database management system.

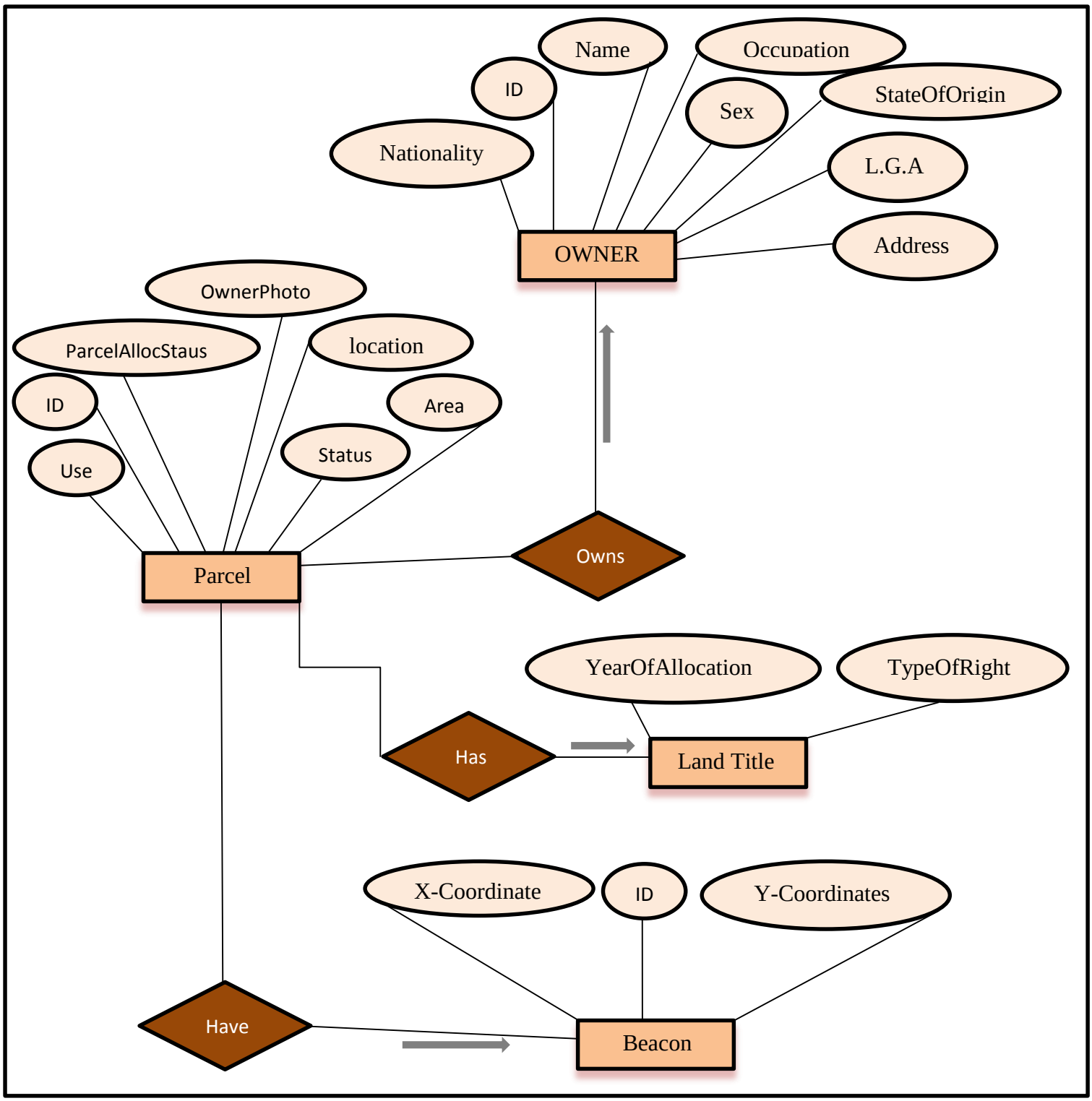



**Figure 3.3: Entity Relational Diagram of Cadastral Information System**

**Source: Author's Analysis, 2017**

### 3.3.6 Method of Data Analysis

In order to achieve the stated aim and objectives of this study, the data required to achieve each objective and the technique of analysing.

**Objective 1: identify and map the existing parcels in the layout plan of the study area.**

The scanned and georeferenced layout plan of the study area was digitised. On- screen digitisation of features such as land parcels and roads was performed by tracing the boundary of each parcel and road from the layout plan through the shapefiles created in ArcGIS. Roads were digitized as lines and parcels and boundary as polygons.

The implication of this conversion of the manual layout plan into a computerised or digital format is for easy manipulation and editing or updating. After the updating process of the geometric data (map), the gleaned information about each parcels were inputted into the created fields in the attribute table of the spatial database (layout map)

**Objective 2: understanding the extent of compliance of road networks and land uses with the original layout plan in the study area.**

To achieve this objective, the digitised layout plan of the study area was first overlaid on the satellite imagery of the study area. The layout plan of the area and the satellite imagery were used as guide to ascertain the compliance level of road networks of the area and the land use information obtained from the administration of the adjudication form helped to determine the compliance level of land use on ground with the proposed land uses in the proposed layout plan. Maps and Tables on both the proposed land use and the existing land use were created, these show contravening physical development in the area.

In order to determine the compliance level of the road network on ground with the layout plan of the area, the road network of the area was digitised from the Google Satellite Imagery of the area acquired which represent the currently situation on ground, after which ground truthing was carried out. The digitised road network from the satellite imagery displays the level of compliance of roads in the area.

**Objective 3: identify and categorize the existing land owners in the study**

This was achieved by creating geodatabase or inventory of all the parcel owners in the study area as contained in the adjudication forms administered to them in the study area. Some of the information collected includes the allottee names, occupations, States, and addresses. The database was queried to obtain the categories of land owners such as, the gender ratio of land owners, their occupations and their States of origin.

**Objective 4: examine the categories of parcels in the study area**

This involved analysing and querying the cadastral geodatabase which was achieved using query language and through various analytical tools in the ArcGIS 10.1software. Querying analysis was employed in order to ascertain the nature of parcels from the data collected. Querying is the process of questioning the database using a Sequential Query Language SQL. Query to discover the parcels that were undeveloped, the rights of occupancy of parcel and the parcel use were carried out.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

## 4.1 INTRODUCTION

This chapter presents the results obtained in the course of the analysis. The chapter is organised into four segments. The first segment presents the results obtained on mapping the parcels in the study area. The second segment presents the compliance level of road network, total numbers of parcels and parcel use existing in the area. The third segment presents the categories of parcel owners while the fourth segment present the results on the different land uses, right of occupancy and land status.

## 4.2 MAPPING EXISTING PARCELS OF LAND IN THE AREA.

Figure 4.1 shows the existing parcels in the area. After mapping by directly digitising the parcels in the layout plan of the study area as shown in Appendix II it was discovered that there were 670 land parcels in the layout plan of the study area.

Since the manual proposed layout plan is dearth of current mutation as such the subdivision of land parcels and also changes in roads were not reflected. After the process of updating and upgrading of the digitised layout plan through survey and the using the satellite imagery of the area as a guide which gives the existing state on ground, the monotonous traditional geometric data (layout map) was rejuvenated been given a new streamlined design (Spatial database). It was discovered that the total existing parcels in the area as shown in Figure 4.1 were 738 land parcels as result of the subdivision as some parcels were divided into two or more segment and sold out in the area. Similarly, in the work of Babalola and Kardam (2012), it was also revealed that plots were further subdivided into smaller or bigger sizes than earlier designed in Part of Fadaman-Mada Area of Bauchi Metropolis.

An error was discovered, validating the gross inefficiency and shortcomings of the cumbersome tradition cadastre record keeping method; the aggregate plots in the traditional layout plan of the area was recorded as 411 as shown in Appendix II, but on the contrary, the

result of the digitisation of the traditional layout plan automatically shows there were actually 670 plots of land proposed in the area.

Cadastral maps are dynamic; they must reflect the daily changes in the cadastral framework arising from land development.

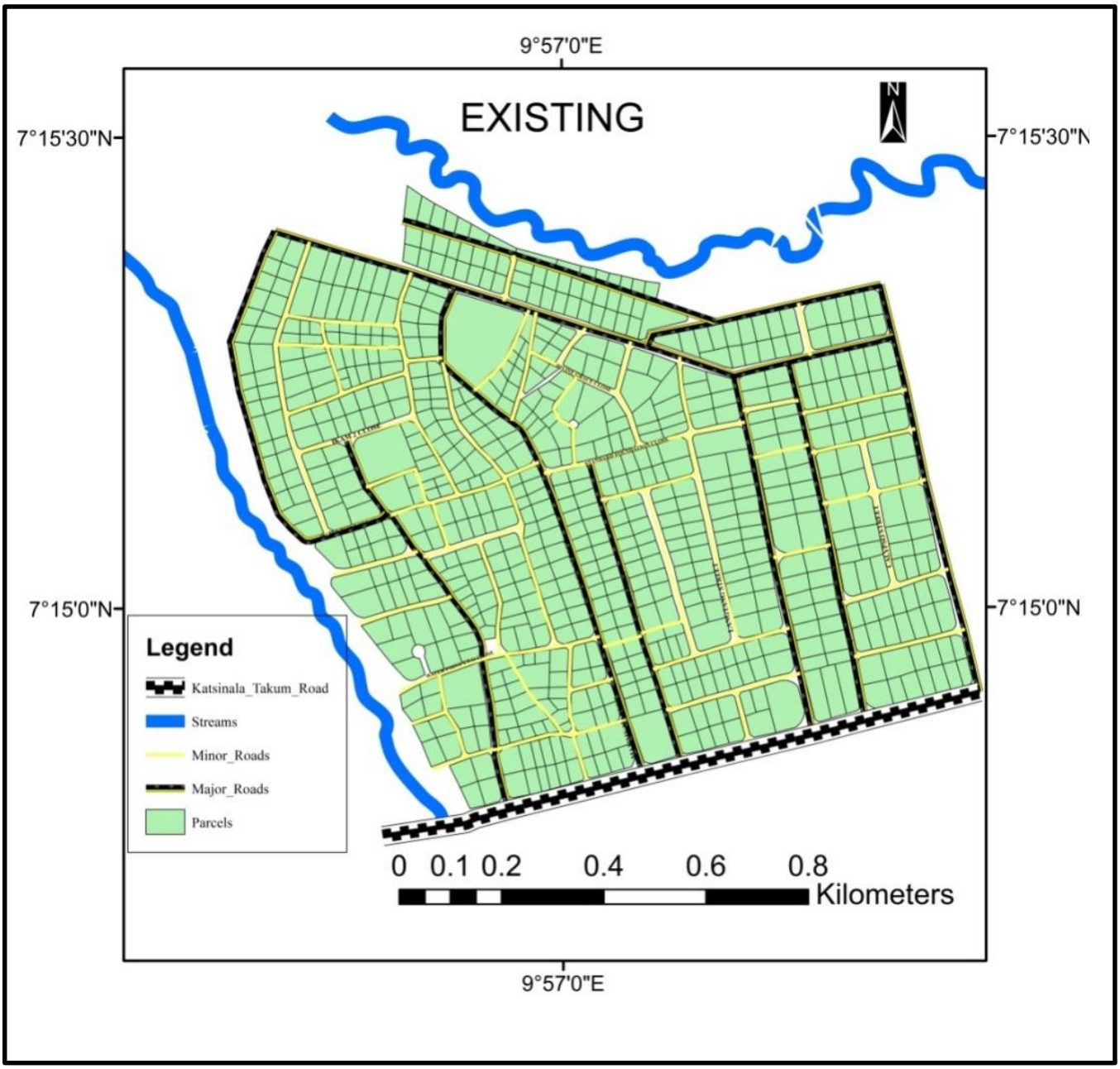



**Figure 4.1: Existing Parcels of Mammy Settlement**
**Source: Author's Analysis, 2017**

## 4. 3 EXTENT OF LAND USE AND ROAD COMPLIANCE TO PROPOSED LAYOUT PLAN

This section shows the extent to which the road networks and land uses and their sizes (hectares) in the study area complied with the layout plan of the study area.

### 4.3.1 Road Network Compliance

This sub-theme shows and discusses the level of compliance of the road network with the proposed layout plan of the study area. Table 4.1 displays the change in the proposed road networks in the area.

**Table 4.1: Road Network Compliance**

| Road | Frequency | Change (%) |
|---|---|---|
| Proposed (1982) Major Road | 10 | |
| Existing Major Road | 11 | |
| | | **10%** |
| Proposed (1982) Minor Road | 42 | |
| Existing Minor Road | 54 | |
| | | **28.6%** |

**Source: Author's Analysis, 2017**

Table 4.1 depicts a simple analogy between the proposed (1982) and the existing roads. The results of the analysis as shown in Table 4.1 and Figure 4.2 infer that the numbers of both major and minor roads in the proposed layout plan of the study area and the existing road networks were in disparity. The total numbers of the proposed major roads in the area was 10 while the minor roads were 42. Conversely, the existing major roads in the area were 11 while the minor roads were 54. It was discovered that there was 1 additional major road in the area and 12 more minor roads. The Major road in the study area had increased in 10% while the minor increased about 28.6%. This is similar to the work of Shekwoaga (2016),

which revealed that there was deviation of the existing road from the proposed road in Minna Metropolis as what was proposed for the neighbourhood(s) was clearly different from what was on ground while others houses were built on them creating a clear contrast of what was proposed with respect to what exist.

Figure 4.2 depicts the proposed and the existing road networks in the area. This displays the compliance level of the existing roads with proposed road in the plan.

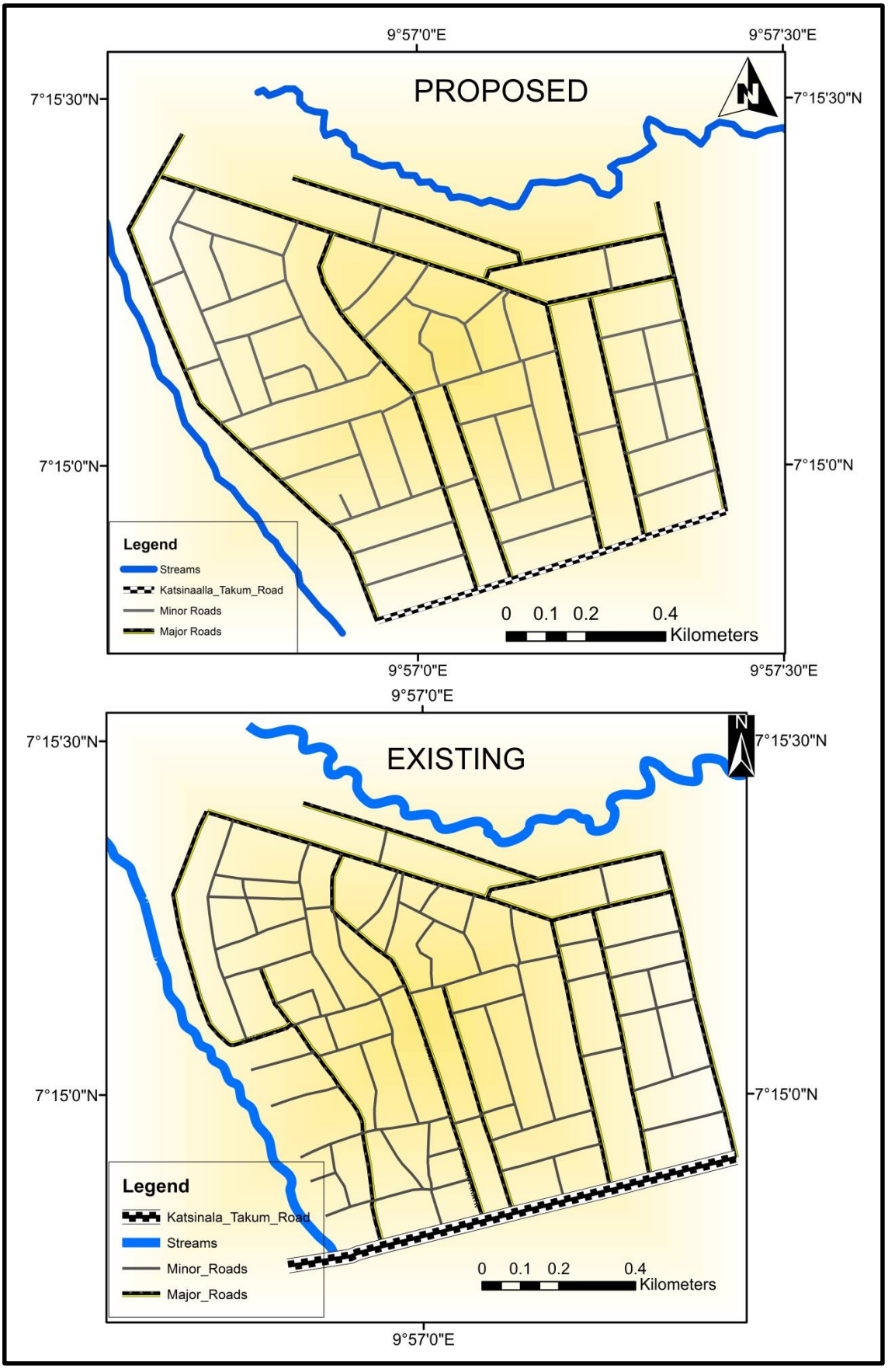



**Figure 4.2: Road Network Compliance**
**Source: Author's Analysis, 2017**

According to a land officer from the TSBLS, "the deviation of the existing roads from the proposed was due to the creation of more necessary roads by parcel owners in the area but no update had been done on the proposed layout plan of the area to effect the mutation".

### 4.3.2 Parcel Uses Compliance

This section discusses the compliance level of parcels allocated for a particular purpose(s). In the proposed layout plan, which is a residential layout, certain parcels were earmarked for various purposes apart from its residential purpose as depicted on the proposed layout plan map in Appendix II and in Table 4.2.

**Table 4.2: Proposed Parcel Use**

| Parcel(s) Purpose Allocated: | Approved No of Parcel(s): | Hectares (Ha): | Percentage |
|---|---|---|---|
| Residential | 657 | 74 | 91.37 |
| Commercial | 5 | 3 | 3.75 |
| Institutional | 5 | 3 | 3.20 |
| Vacant (Children Playing Ground) | 3 | 1 | 1.68 |
| **TOTAL** | **670** | **81** | **100.0** |

**Source: Author's Analysis, 2017**

In the proposed layout plan, there were four (4) proposed land uses which were classified into; residential, commercial, institutional and vacant parcels as shown in Table 4.2 and Figure 4.3a and Figure 4.3b, the commercial parcels comprised the market/motor park, a petrol filling station, provision shops and a dispensary. The institutional parcels were the parcels to be used for educational, religious purpose and also for Government establishments like the Fire Service and Postal Agency. While the vacant parcels were the children's playing ground.

The existing parcel use in the area is presented in Table 4.3. The table displays the diverse parcel uses and hectares coverage in the study area.

**Table 4.3: Existing Parcel Use**

| Parcel(s) Existing: | Existing No of Parcel(s): | Hectares (Ha): | Percentage (%) |
|---|---|---|---|
| Residential | 430 | 51.75 | 53.88 |
| Commercial | 29 | 3.92 | 4.08 |
| Institutional | 21 | 4.84 | 5.04 |
| Vacant | 113 | 17.02 | 17.72 |
| Agricultural | 123 | 15.90 | 16.56 |
| Mixed (Resid. + Comm.) | 22 | 2.61 | 2.72 |
| **TOTAL** | **738** | **96.04** | **100.0** |

**Source: Author's Analysis, 2017**

Contrary to the proposed classes of parcel use in the layout out plan, the numbers of the existing parcel use in the area were six (6), lucidly deviating from the proposed four (4) classes of parcel uses. The existing parcel uses in the area include the residential, commercial, institutional, vacant, agricultural and mixed (residential + commercial) purpose. It was ascertained that there were two (2) more additional parcels uses which were the agricultural and the mixed; these parcel uses of course replaced most of the allocated or proposed residential parcels.

Findings revealed that there was an apparent increase in the numbers of parcels in the area as shown in Table 4.3 this was due to the subdivision of parcels in the area. Also, there found to be an increase in the hectares of the total parcels because few of the land space which were not designated for any purpose in the proposed layout plan were found to be now inhabited with several buildings being erected as shown in the existing land use map in Figure 4.3a. This of course, contributed to the increase in numbers of the existing parcels and

also the reason behind the increase in hectares of the study area contradictory to the proposed total parcel hectares.

Figure 4.3a and Figure 4.3b gives a thumbnail on the changes and conversion of land use from the proposed layout plan of the area. This deduced a high level of non-compliancy of land use in the area.

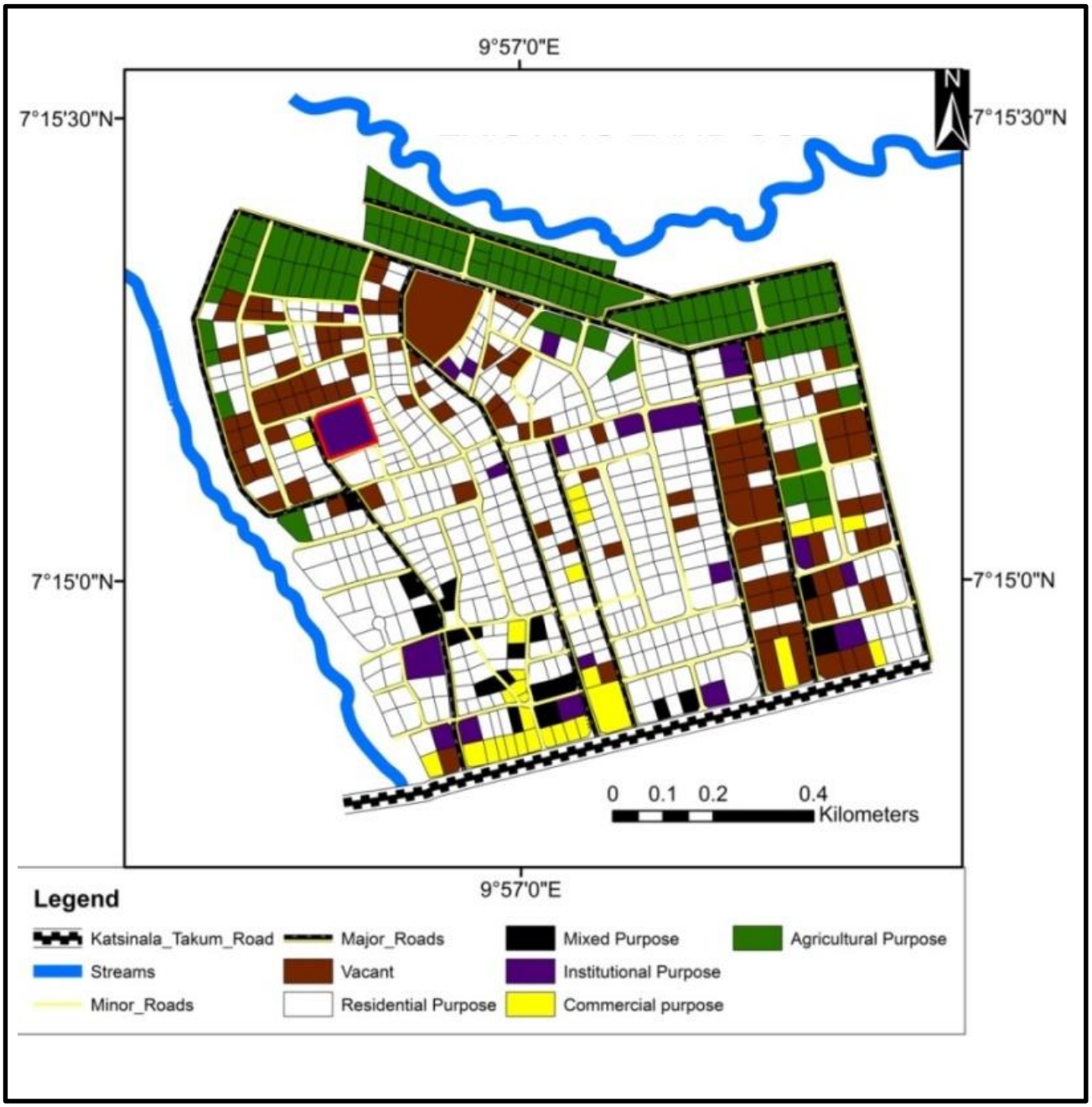



**Figure 4.3a Existing Land Use**

**Source: Author's Analysis 2017**

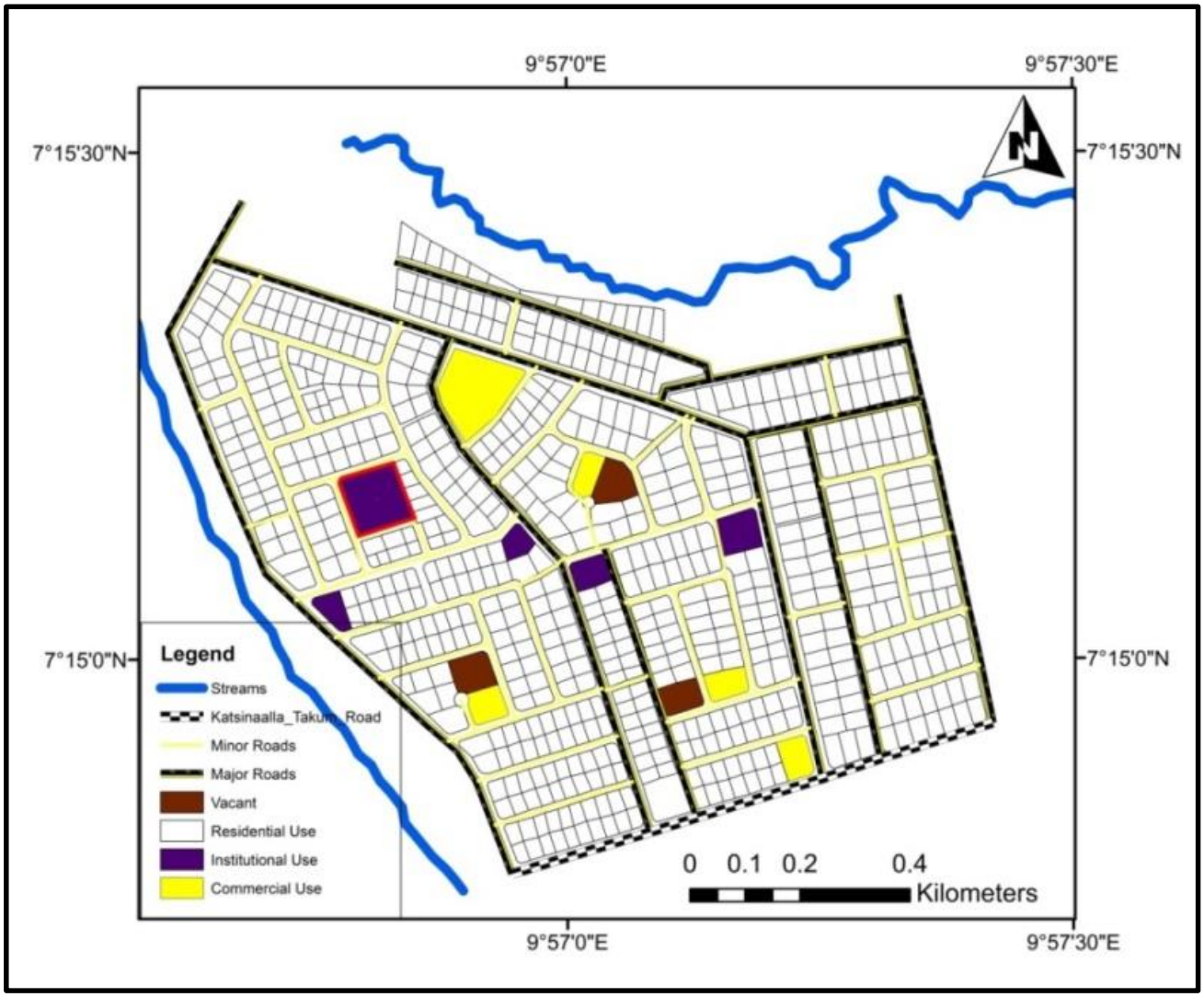



**Figure 4.3b Proposed Land Use**

**Source: Author's Analysis 2017**

Further findings also revealed that even though residential parcels maintain the highest proportion in numbers and in hectares in the area, there was still a decline in the numbers and in percentage of hectares of parcels designed for this purpose from 657 parcels to 430 and 91.37% to 53.88% respectively, mainly because of the replacement of those residential parcels with agricultural and mixed use. This finding is similar to a finding in the work of Shekwoaga (2016), in which there were changes in land use from residential to mixed and public land uses even though there was no provision of mixed land uses in the proposed plan in Minna.

It was also shown in Table 4.3 and Figure 4.3 that there were increases in the numbers of commercial, institutional and vacant parcels conflicting to the proposed land use as shown in Table 4.2 and Figure 4.3. These also contributed to the decline in residential parcels, showing non-compliance to the proposed layout plan. Other changes were the conversion of commercial land uses such as market to mixed land uses and playing ground. Some residential land uses were replaced by few churches.

It was discovered that almost all of the parcels earmarked for various uses aside residential uses were not in compliance as only one (1) of the parcels allocated for institutional use (a Primary School); the parcel with a red colour boundary in Figure 4.3 was in full compliance. The parcel proposed for this Primary School was been utilized for its purpose, howbeit, there exist four (4) more Primary Schools in the area in contrast to the one (1) Primary School proposed. Among the proposed commercial, institutional and vacant land uses, only this primary school parcel (institutional) complied. Most of the parcels allocated for these uses existed in the area but with different aggregates and locations on ground contrasting the proposed plan. Only two approved sites for development in the layout plan were not in the area which were the parcels allocated for Fire Service and Postal Agency, the study area is void of these land uses. By implication, the spaces (parcels) allocated for these uses were converted to different purposes. This is due to the ineffective implementation of development control in the sites to ensure conformity. This has led to unguided physical development.

According to Shekwoaga (2016), land use change process was identified as one of the major challenges that make most land owners or developers deviate from the approved building plan or develop what is contrary to the use allocated to them. The process is cumbersome and has a lengthy bureaucratic procedure.

## 4.4 EXISTING LAND OWNERS AND THEIR CLASSIFICATIONS

### 4.4.1 Existing Land Owners

This section shows the list and some details of the current parcel owners in the study area which was collected through the administration of adjudication form to the parcel owners. This facilitates the creation of the attribute database of land owners in the area. Appendix IV shows that the parcel owners in the study area all together were 653 in number. By implication, since the total number of the existing land parcels (738) were greater compared to the total number of owners it simply implies that some parcel owners possess more than a parcel of land as there were some owners that individually had up to five (5) parcels of the land but must of parcel owners had just a single parcel. In a situation where the aggregate land owners are greater in numbers than the parcels, it then means there are issues to resolve in regard to land ownership. These findings are similarl to the work of Bala (2011), who also discovered that some individuals own more than a plot in Kabama Estate, Sabon Gari, Zaria.

These land owners includes both male and female of different vocations, people from diverse parts of the country, far and near, but majority of the land owners were the indigenous Kuteb people who were predominantly civil servants and farmers in the community while the immigrants most especially the Igbos are predominantly businessmen and women.

### 4.4.2 Classification of Land Owners

This sub-theme discusses the different classes of land owners in the study area in terms of their gender, occupation, and whether they are Indigenes or non-indigenes.

*4.4.2.1 Land Owners Gender*

The result of the analyses (Appendix V) in Table 4.4 displays the ratio and proportions of both the male and female gender in the area.

**Table 4.4: Gender of Land owners**

| Gender | Frequency | Percentage (%) |
|---|---|---|
| Males | 566 | 86.68 |
| Females | 87 | 13.32 |
| **TOTAL** | **653** | **100** |

**Source: Author's Analysis, 2017**

The inference drawn from Table 4.4 is that, the male gender had the highest proportion as land owners in the area with 86.68%. On the contrary, the female land owners constituted a very low proportion (13.32%). This also implies that the male gender have the highest numbers of parcels in the area. The result shows a magnitude of gap in land ownership between the male and their female counterparts as vast majority of land owners were male

Inheritance norms are usually the most frequent source of transfer of ownership of land. As a result of the custom of the indigenous Kuteb people, women are much less likely to inherit land, except in the few cases where there were no male counterparts in the family. In addition, there was usually male privilege in labour, education, and financial services which have tended to be biased towards men. Women were less likely than men to own land. The men work harder to earn money, and as the bread-winners or prospective bread-winners and head of the families, they needed to buy lands and build houses.

Similarly, in the work of Atanlode (2014), revealing that the male parcel owners were the highest land owners in Sunshine Estate, Akure South local Government Area, Ondo State but with the proportion of 90% while the female owners had just 10%. The proportion of the male land owners in Sunshine Estate is higher compared to the proportion of male owners in Mammy Settlement, correspondently; the proportion of the female land owner counterpart in Mammy settlement is greater compare to the female owners in Sunshine Estate.

Likewise in the work of Wulga (2014), the male were the highest parcel owners in Bajiram, Adamawa State, while the female land owner had the lowest proportion (4.81%). In both the works of Atanlode (2014) and the work of Wulga (2014) the proportions of female land owners were very low as compared to the 13.32% in Mammy setlement, Takum Local Government Area, Taraba State.

In this study, after querying the cadastral database, it was further revealed that 101 parcels out of the 738 total parcels belonged to the females. The fact that parcels possessed by females were greater than the total female parcel owners (87) in the area, it implies that some of the female parcel owners had more than one parcel.

*4.4.2.2 Occupations of Land Owners*

The result of the analyses as shown in Table 4.5 displays the numbers and proportions of the occupations of land owners in the area. The occupations of land owners were classified into seven: They were the artisans, business, civil servants, and the farmers.

**Table 4.5: Occupations of Land owners**

| Occupation | Frequency | Percentage (%) |
|---|---|---|
| Artisan | 8 | 1.23 |
| Business | 158 | 24.20 |
| Civil Service | 301 | 46.09 |
| Farmer | 183 | 28.02 |
| Others | 3 | 0.46 |
| **TOTAL** | **653** | **100.0** |

**Source: Author's Analysis, 2017**

At a cursory look at Table 4.5, it is crystal clear that land owners who were civil servants in the area were more with a proportion of 46.09% followed by farmers (28.02%). On the contrary, in the work of Wulga (2014), the researcher discovered that farmers

(90.55%) were the predominant land owners followed by civil servants (9,43%) in Bajiram, Adamawa State. This is basically because Bajiram is more of rural and located has far as 11km from the Local Government Headquarter as such most of the land owners were farmers. Unlike Mammy Settlement, 5km south of Takum the Local Government Headquarters is an extension of the Local Government Headquarter. As a result some of the Local Government Staff, some of the teachers in the various schools, some of the staff in most of the Government establishments like the Education Board, INEC office, Prison Service, Police Force and other private cooperation based in Mammy Settlement which is considered more secured and tranquil due to its proximity to the Army Barracks.

Farmers (28.02%) were the second highest land owners in the area. Table 4.6 b shows how most of the parcel owners were the indigenous people of the area. In most cases, in every geographic area, the indigenes are found to possess more land compared to the immigrants or settlers since it's their ancestral home. As such they seem to be the ones with more land mass for farming activities and other uses. Farmers were the second highest land owners in the area because most of the indigenes that were not civil servants were farmers.

The next were businessmen and women with the portion of 24.20%, encompassing mostly the immigrants most especially the Igbos. The least proportion of land owners in the area is those that belong to the class of others which includes the applicants with the proportion of 0.46%.

**4.5 CATEGORIES OF PARCELS.**

This section displays and discusses the results of the analysis of the cadastral geodatabase on some of the manifold categories of parcels in the area. The categories were the different classes of parcels in terms of the status of parcels; that is whether the parcels were developed or non-developed, the state of occupancy of the lands; whether statutory or customary right of occupancy, the different land uses of the parcels and lastly the year range of parcels purchase.

### 4.5.1 Parcels Status

This sub theme simply shows and discusses the areas or parcels of land which were developed and those that were not developed. Table 4.7 shows the numbers and the proportions of the parcel status in the area.

**Table 4.7: Parcel Status**

| Parcels Status | Frequency | Percentage (%) |
|---|---|---|
| Developed | 307 | 42 |
| Undeveloped | 431 | 58 |
| **TOTAL** | **738** | **100** |

**Source: Author's Analysis, 2017**

Table 4.7 displays the result of an analysis (Appendix V) on the parcel status in the area. The result shows that most of the parcels in the area were undeveloped representing 58% of the total parcels while only 42% of the parcels were developed. This finding is somewhat similar to the finding of Atanlode (2014), in Sunshine Estate, Akure South Local Government Area, Ondo State where the undeveloped parcels had the highest proportion (88.9%) but with a very high percentage of non-development compared to Mammy's undeveloped parcels (58%). The proportion of developed parcels in Sunshine Estate was 2.1% very low compared to the developed parcels (42%) in Mammy. This could be extrapolated that Mammy Settlement is more developed compared to Sunshine Estate, Akure South Local Government Area, Ondo based on the findings.

On the contrary, in the work of Wulga (2014), it was also revealed that more land were developed with the proportion of 67.76% parcels in Banjiram, while the non-developed parcels were 32.24%.

The status of parcels in the area: the developed and undeveloped parcels are displayed in Table 4.4.

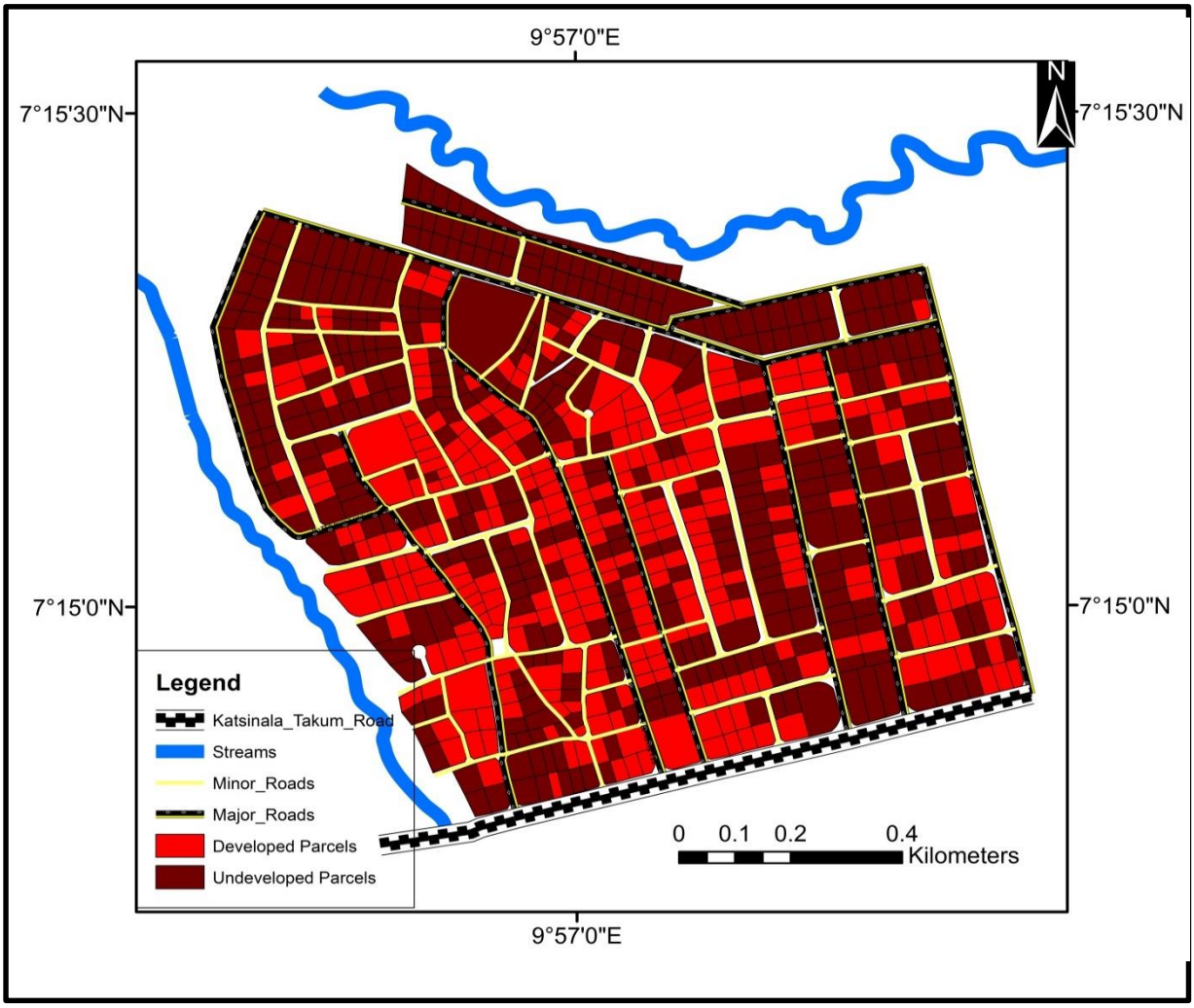



**Figure 4.4: Parcel Status**
**Source: Author's Analysis, 2017**

Figure 4.4 displays the map of the developed and undeveloped parcels in the area. This implies that greater proportions of the parcels in the area were not developed compared to the developed parcels in the area. The undeveloped parcels encompass the vacant parcels without buildings, the agricultural land use parcels and even the residential land use parcels that were not developed; those were the low residential areas.

The high proportion of non-developed parcels in the area is basically as a result of the low standard of living of most of the parcels owners most especially the farmers which were the second highest land owners in the area. Secondly the agricultural land use were the second highest land use in the area followed by the vacant land, these together with fact that the area is deemed a rural area contributes to the undeveloped lands in the area.

### 4.5.2 Right of Occupancy

This sub theme displays the result of the analysis on the right of occupancy in the area and discusses the results on the parcels with statutory right of occupancy and those with customary right of occupancy.

Right of occupancy as the word implies is the right or grant of occupancy accorded unto an individual to occupy a given piece of land by the Government. Under the Land Use Act 1978, there are two types of rights of occupancy recognized by the Act. These comprise of Statutory right of occupancy and Customary right of occupancy. Both Statutory right of occupancy and Customary right of occupancy are of two classifications.

The first is the Statutory right of occupancy granted by the State Governor and the Customary right of occupancy granted by the Local Government. The second classification is the Statutory right of occupancy deemed to have been granted by the State Governor and the Customary right of occupancy deemed to have been granted by the Local Government.

In both cases of Statutory and Customary rights of occupancy, therefore, there exists an actual grant as well as a deemed grant. An actual grant is naturally a grant expressly made by the Governor of a State or a Local Government whilst a deemed grant comes into existence automatically by the operation of law.

The two different right of occupancy obtained by the parcel owners are presented in Table 4.8.

**Table 4.8: Right of Occupancy**

| Right of Occupancy | Frequency | Percentage (%) |
|---|---|---|
| Customary | 401 | 54 |
| Statutory | 337 | 46 |
| **TOTAL** | **738** | **100.0** |

**Source: Author's Analysis, 2017**

Table 4.8 shows the result of analysis on the right of occupancy of lands. The finding reveals that customary right of ownership had the highest proportion right of occupancy of parcels in the area. Customary right of occupancy had 54% while the statutory right of ownership had 46% of the parcels.

The reason for the high customary right of occupancy is based on the fact that Mammy Settlement is under a Local Government Area and is considered a rural area. As such customary right of occupancy is the predominant right. This right of occupancy can only be issued by the Local Government authority which is closer to the people and easier to be granted compared to the statutory right of occupancy granted by the State Government which is very difficult and time consuming before granted and in most cases, the land owners find it difficult heading to the State Capital to process the statutory right of occupancy. Even though Mammy Settlement is considered a rural area there still exist owners with statutory right of occupancy, this portrayed the fact that the State Governor has the exclusive power to grant the statutory right of occupancy in respect to any land in the territory of the State to any person, whether the land is located in an urban or rural area.

### 4.5.3 Classification of Parcels Based on Uses

This section displays in a map and table and discusses the result of the queried cadastral geodatabase on the parcels used for a particular purpose. The land use of the area were categorised into: Residential use, commercial use, institutional use, agricultural use, mixed purpose and parcels that were just vacant or bare.

The land use map of the study area is presented in Figure 4.5. This displays both the distributions and locations of every parcel use in the area.

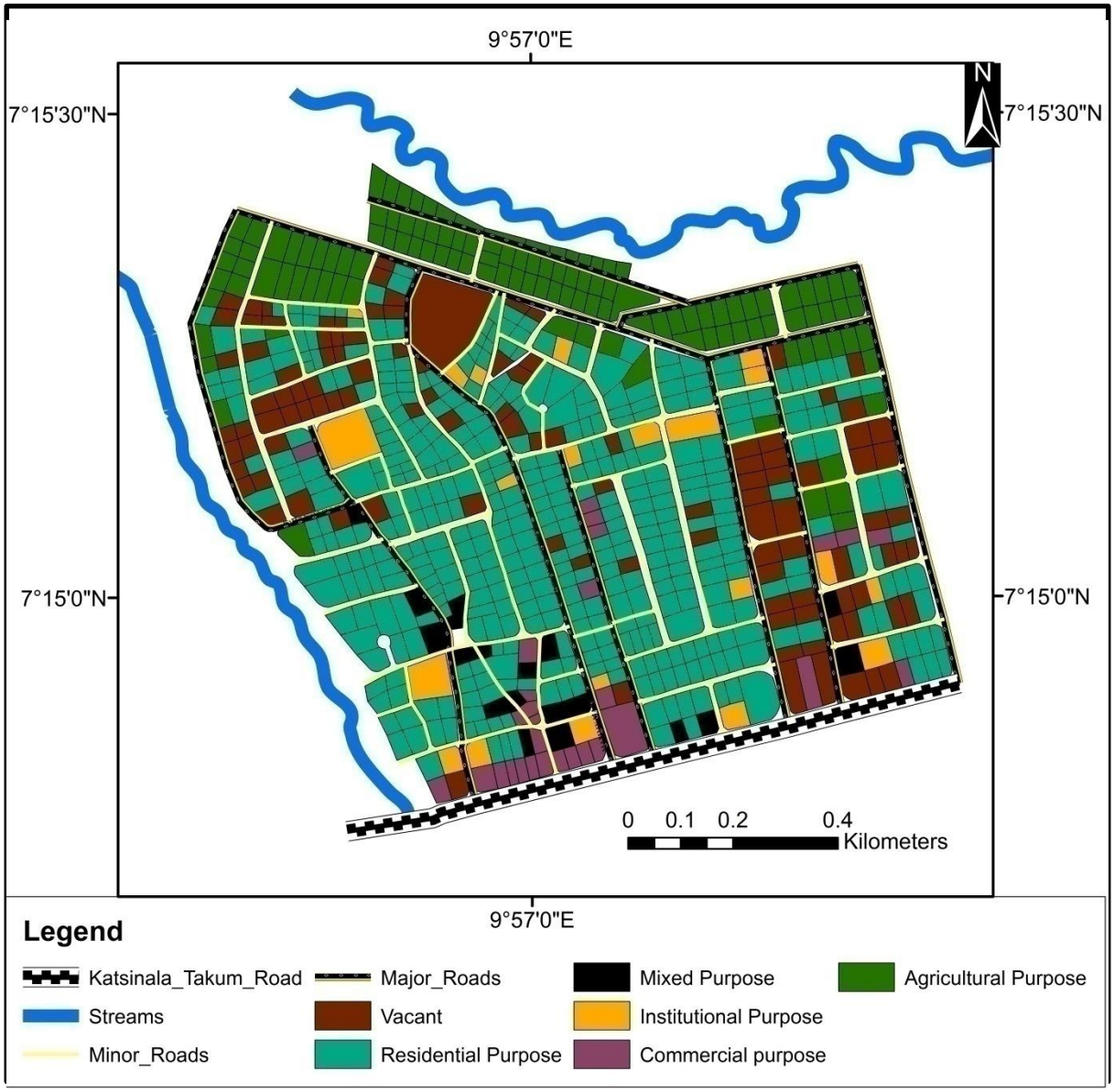



**Figure 4.5: Land Use Map of Mammy Settlement**
**Source: Author's Analysis, 2017**

The statistic of land use in the area is presented in Table 4.9. This shows the numbers of each of the six (6) land uses in the area and their proportions.

**Table 4.9: Land use of Mammy Settlement**

| Parcel Uses | Number of Parcels | Percentage (%) |
|---|---|---|
| Residential | 430 | 58 |
| Commercial | 29 | 4 |
| Institutional | 21 | 3 |
| Agricultural | 123 | 17 |
| Mixed | 22 | 3 |
| Vacant | 113 | 15 |
| **TOTAL** | **738** | **100.0** |

**Source: Author's Analysis, 2017**

*4.5.3.1 Parcels Used for Residential Purpose*

The result of the analyses as shown in Figure 4.5 depicts the parcels used for various purposes. Table 4.9 shows that the predominant parcel uses in the area were residential purpose. The parcels used for residential purposes had the proportion of about 58% as the prevalent land use in the area even though higher percentage of the designated parcels were initially allocated for this purpose in the proposed plan. High proportion of the proposed residential parcels had been converted or replaced with other land use types most especially the agricultural activities leading to it decline both in numbers and sizes (hectares). Vast majority of the parcels in the area were used for residential purpose because the layout of the area is primarily a residential plan, as such, it is therefore expected that the existing physical development in the area will be largely residential land use. The residential parcels comprises of both the developed residential parcels and the low residential.

*4.5.3.2 Parcels Used for Commercial Purpose*

Table 4.9 infers that the parcels used for commercial purpose in the area were 4% of the aggregate parcels in the area. This is the second parcel use in the area. These commercial activities were predominantly at the Mammy market area which is at the forefront of the study area, directly facing the ADA Army Barracks. This is where one could find all kinds of provision shops, Saloons, dispensaries, stores and many other social joints. Most of the armies and their families from the Barracks also frequently patronize the market. Some of the commercial activities taking place in this parcels include, mechanic, carpentry, block manufacturing, bricklaying among others.

*4.5.3.3 Parcels used for Institutional Purpose*

The spatial distribution of parcels used for institutional purpose is shown in Figure 4.5.The institutional activities going on here were classified into religious encompassing different churches and a mosque, and the educational centres (Nursery, Primary and Secondary Schools).

From Table 4.9, it is clear that institutional land use is among the least land use in the area. The proportion of institutional land use is just 3% of the total land use in the area. Institutional land use together with mixed land uses were the two least proportion of land use in the area even though they encroached on the residential land use opposing the proposed layout. They were scanty and sparsely distributed in the area as shown in Figure 4.5.

*4.5.3.4 Parcels Used for Agricultural Purpose*

Table 4.8 reveals that agricultural land use in the area had the second highest proportion of land use in the area. The proportion of agricultural land use is 17% out of the total percentage of land use in the area. It was next to residential land use. This land use type was dominant at the rear of the area as shown in Figure 4.5 which is found to be pasturable and arable with close proximity to the stream while few were found within built-up areas. On these parcels, rearing of animals and other farming activities were taking place. The farm

lands produce few/small scale of farm products and are consumed locally. These agricultural parcels were gradually replaced and converted to other uses most especially residential as a result of population increase and urbanization. In the nearest future agricultural activities may cease in the area as presently most farmers move outside the area across the stream for farming activities because the arable land is no longer sufficient for larger scale agriculture. It is pertinent to note that agricultural land use was not at first included in the layout plan of the area; land owners opted to use the vacant and fertile land for agricultural purpose.

*4.5.3.5 Parcels Used for Mixed Purpose*

Mixed purpose parcels are parcels that were used for more than one purpose. Most of those mixed uses were the residential parcels used in accompaniment with commercial use. Table 4.9 shows that mixed purpose parcels were among the parcels with the lowest proportion of uses in the area. Akin to institutional use, mixed parcels use also had 3% out of the total percentage of the land use types in the area howbeit mixed purpose parcels was not included in the proposed layout plan.

The land owners' entrepreneurial spirit and the strategic location of the parcels could warrant the utilization of those pierce of lands for mixed purpose.

*4.5.3.6 Vacant Parcels*

The results of analysis revealed that 15% of the total proportion of land use type in the areas shown in Table 4.9 was vacant. This makes vacant parcels the 3$^{rd}$ prevalent land use type in the area next to agricultural land use. The vacant parcels were the dormant parcels without any form of structure or activity taking place in them. That is, they were neither used for agriculture nor any form of building found in them. These were the green lands with bushes and few shrubs in them, but in few cases they were used as playing ground or football fields.

Some of these vacant lands in the area were as a result of the non-readiness of the parcel owners to erect structures which may be due to financial incapability, the unsuitability

of the parcel for agricultural activities and or the intent of some of the parcel owners to vend the parcels in future.

### 4.5.4 Year of Land Possession

This sub-theme displays the year range in which lands in the area were possessed; this is to ascertain the year interval. The year interval of eight was purposively chosen from the year of the creation of the analogue layout to 2016.

**Table 4.10: Years of Land Possession**

| Years Interval | Number of Parcels | Percentage (%) |
|---|---|---|
| 1982-1990 | 75 | 10.16 |
| 1991-1999 | 189 | 25.61 |
| 2000-2008 | 308 | 41.87 |
| 2009-2016 | 65 | 22.36 |
| **TOTAL** | **738** | **100.0** |

**Source: Author's Analysis, 2017**

Table 4.10 displays the result of the queried spatial database on the year intervals within which the various land parcels in the area were possessed. The result of the analysis shows that there was an unusual high rate of land purchase within 2000–2008; most of the parcels were purchased within these years interval. This could be linked to the influx of the refugees and the victims of the communal crisis between the Chamba and the Kuteb ethnic groups in 1996-1998 at Takum local Government and its environs.

The Kuteb rivals being at the receiving end and most affected by the crisis fled their burnt houses to the present Mammy Settlement, opposite the Army Barracks for refuge. This influx of refugees ensue an unprecedented high purchase rate of lands in the area.

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 5.1 SUMMARY OF FINDINGS

This study has attempted to develop a cadastral information system for Mammy Settlement, Takum L.G.A, Taraba State. Four research questions were formulated to guide the study among which is to identify and map the existing land parcels in the study area, examine the extent of compliance of roads and land uses with the original layout plan in the study area, identify and classify the existing land owners, and to examine the categories of land parcels.

After the analysis, it was discovered that there were 738 existing parcels of land in Mammy settlement. There was a very high level of non-compliance of the existing road network and parcel uses with the proposed layout of the area. It was also gathered that the total numbers of parcel owners were 653 majority of which were male with proportion of 87%. Also worthy of note is, 42% of the total parcels in the area were undeveloped. About 54% of the parcels in the area possess customary right of occupancy; this is not surprising as the study area is in rural area. From the five classes of occupations of land owners, almost half of the parcel owners in the area were the civil servants with the proportion of 46.09%. It was also ascertained that majority (81.32%) of the land owners in the area were the indigenes of Taraba State. Several land uses also existed in the area, these include, residential, agricultural, commercial, institutional, mixed and vacant land. Residential land use was found to have the highest proportion with 58%.

In addition, the analysis on compliance level of road network and land uses revealed that there was high level of non-compliance with the proposed plan as more roads were created and a number of land uses were converted to other uses. From the parcels assigned for public uses, only one of the parcels proposed for a primary school complied with the layout plan of the area.

## 5.3 CONTRIBUTIONS TO KNOWLEDGE

1. Developed a cadastral information System for Mammy settlement, Takum Local Government Area, Taraba State.
2. Identified high level non-compliance of the existing road network and parcel uses with the proposed layout design for the study area.
3. This research will create awareness on the importance and efficiency of digital land management for the State Bureau of land and Survey to emulate.
4. Largely, this research will add to the existing knowledge of Geography Information System (GIS) in the application to land administration and management.

## 5.3 CONCLUSION

Land forms the basis for all forms of human activity, the usefulness of land is enormous; therefore man has to guard and manage it jealously considering its scarce nature. The traditional method of land management is the common practice in most regions most especially in Africa. While the analogue method of land management has proved to be inefficient and cumbersome as it faces many problems like difficulty in sharing, high cost of maintenance, and the lack of security among others, it may be better and appropriate to develop a digital based land information system for effective and efficient management of land and all matters related to it.

The set aim and four objectives of the study were eventually achieved. From the results of the study, it can be concluded that the computerised method of land record keeping is flexible as it facilitate the future updating, analysing, sharing, retrieving and security of land informationfor planning and administration. It can also be concluded from the results of the analyses carried out that the proposed layout plan does not reflect the situation on ground as the total plots of land, road network and parcel uses existing in the area were not in total agreement with the proposed layout plan. This was basically as a result of the analogue state of the layout plan, updating it in this form is a more difficult project to undertake.

## 5.4 RECOMMENDATIONS

Based on the finding of this research, the following recommendations are made:

1. The process of digital cadastre in this study should serve as a model to be adopted and replicated by the Government in creating database for all landed properties which will be updated from time to time.
2. The State Government should employ GIS technology in creating Cadastral Information System in the State to enhance effective and efficient cadastral management.
3. The preparation of an up-to-date land use plan, strategic plans for various utilities and facilities. This will effectively guide the growth and development of the area in a sustainable manner, hence ensuring realistic development control measures.
4. The Local Planning Authority should ensure that developers do not deviate from building plans approved for them in the course of implementation (construction) on the plot earmarked for such.

## 5.5 SUGGESTION

Multipurpose cadastral system which incorporates not only land ownership and use, but also; tax information, natural resources, utilities, etc. should be carried out by other researchers as further study or the Government in the area.

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## APPENDIX I: ADJUDICATION FORM

**DEVELOPMENT OF CADASTRAL INFORMATION SYSTEM IN MAMMY SETTLEMENT, TAKUM LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA**

***ADJUDICATION FORM)***

I am **ALEXANDER Iranyang,** a Postgraduate student in Ahmadu Bello University, Zaria and in pursuit of an M.Sc. in Remote Sensing and Geographic Information System. My Thesis Topic is The Development of Cadastral Information System in Mammy Settlement, Takum Local Government, Taraba State, Nigeria.

Please fill the form or provide the required information. This information will not be used for reasons other than research intended to secure the rights of land owners. Thank you.

**SECTION A: PARCEL OWNER PERSONAL DATA**

1) First Name:……..…….,,,,,……

2) Surname:……

3) Owner Identification Number: | | | | | |

4) Sex: a. Male ( )

b. Female ( )

5) State of Origin …….

6) Local Government Area ……..

6) Occupation: a. Farming ( )

b. Civil Service ( )

c. Artisan ( )

d. Others (……)

7) Address……..

8) Phone Number: | | | | | | | | | | |

**SECTION B: PARCEL DATA**

1) Parcel Identification Number: | | | | | |

2) Parcel Size (square metre) | | | | | | | | | |

3) Parcel use: a. Residential ( )

b. Agricultural ( )

c. Commercial ( )

d. Institutional ( )

e. Mixed ( )

4) Parcel allocation status: a. Allocated ( )

b. Not allocated ( )

5) Parcel status: a. Develop ( )

b. Not Developed ( )

6) Parcel Address;……....

(Street name, Block, Subdivision)

**SECTION C: LAND TITLE INFORMATION**

7) Right of Occupancy: a. Statutory ( ) b. Customary ( )

8) Year of Acquisition:

| | | | |
|---|---|---|---|
| 1 | 9 | | |

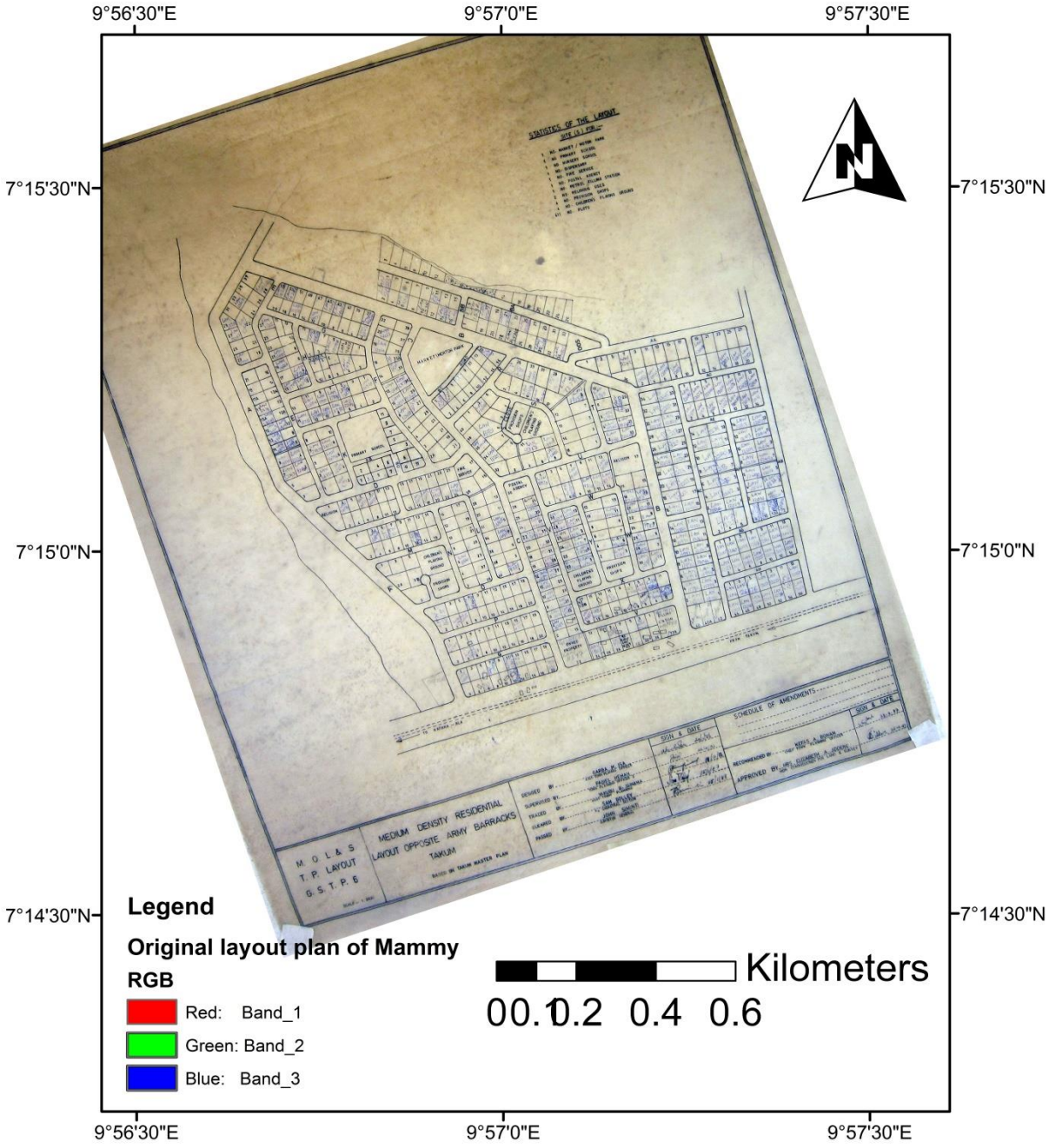
| | | | |
|---|---|---|---|
| 2 | 0 | | |

**SECTION D: NEXT OF KIN**

(Optional)

1. First Name:……..
2. Surname:……..
3. Address:……..……..

## APPENDIX II: ANALOQUE LAYOUT (GSTP 6) OF MAMMY SETTLEMENT



## APPENDIX III: LAND PARCELS OVERLAID ON SATELLITE IMAGERY OF MAMMY SETTLEMENT






# APPENDIX IV: SCREEN SHOT PART OF PARCEL OWNER LIST

Table

Parcel_Owners

| OWN_NAME | SEX | OWN_OCCP | PHONE_NO | NATIONA | STATE | L_G_A | OWN_ADDRESS | NAME_OF_N_O_ | N_O_K_ADDRESS | OWN |
|---|---|---|---|---|---|---|---|---|---|---|
| Aondugu Timothy | Male | Bussiness | <Null> | Nigerian | Benue | Gboko | Divine Grace Street, Mammy | <Null> | <Null> | 73 |
| Benjamin Alpha | Male | Civil_Servant | <Null> | Nigerian | Taraba | Ussa | Sam Tsokwa Street, Mammy | <Null> | <Null> | 94 |
| M. Erick | Male | Farmer | <Null> | Nigerian | Benue | Katsina ala | Standard Foundation Stree, | <Null> | <Null> | 734 |
| Aaron Lucky | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 321 |
| Aaron Tswabki | Male | Civil_Servant | 08109293966 | Nigerian | Taraba | Takum | Mammy Market, Mammy | Jude Aaron | <Null> | 163 |
| Abafalous Samson L | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Standard Foundation Stree, | <Null> | <Null> | 453 |
| Abanger Abanger | Male | Bussiness | <Null> | Nigerian | Taraba | Ussa | Angwan Lantang, Mammy | <Null> | <Null> | 842 |
| Abasiye Caleb Tabki | Male | Civil_Servant | 07039250902 | Nigerian | Taraba | Takum | Sam Tsokwa Street, Mammy | Ametirimam Abasi | RCCN Church Gu Urutishe | 239 |
| Abbasiye Sunday | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Quarter Guard Street, Mamm | <Null> | <Null> | 190 |
| Abdulmaliki Ndotti | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | RCCN Gu Urutishe, Mammy | <Null> | <Null> | 525 |
| Abdulmazid abdullahi | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Standard Foundation Stree, | <Null> | <Null> | 815 |
| Abel Tinyang | Male | Bussiness | 08093923293 | Nigerian | Taraba | Takum | Water Point2, Mammy | Sarah Abel | <Null> | 442 |
| Abershi Nwuniji | Male | Farmer | 07035688785 | Nigerian | Taraba | Takum | Sam Tsokwa Street, Mammy | Fxentso Abershi | Sam Tsokwa St | 469 |
| Abiail Jairus | Fema | Civil_Servant | 08069504538 | Nigerian | Taraba | Kurmi | Divine Grace Street, Mammy | Frieda Jairus | SPY, Yola, Adamawa State | 294 |
| Aboi Maigari | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 832 |
| Abongaby Moses | Male | Bussiness | <Null> | Nigerian | Taraba | Takum | Water Point2, Mammy | <Null> | <Null> | 676 |
| Abubakar Usman | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 797 |
| Adagba Solomon | Male | Farmer | <Null> | Nigerian | Benue | Zaki Biam | Quarter Guard Street, Mamm | <Null> | <Null> | 672 |
| Adamu Ahmed | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 320 |
| Adamu Ishaku | Male | Bussiness | <Null> | Nigerian | Taraba | Takum | Sam Tsokwa Street, Mammy | <Null> | <Null> | 856 |
| Adebola Bread | Male | Bussiness | <Null> | Nigerian | Oyo | Ibadan | Bala Street, Mammy | <Null> | <Null> | 688 |
| Adeka Christian | Fema | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Divine Grace Street, Mammy | <Null> | <Null> | 659 |
| Afiniki Joseph | Fema | Civil_Servant | 07065949333 | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 420 |
| Agada Friday | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Angwan Lantang, Mammy | <Null> | <Null> | 844 |
| Agber Terese | Fema | Bussiness | <Null> | Nigerian | Benue | Tor Donga | Quarter Guard Street, Mamm | <Null> | <Null> | 347 |
| Agya Iliya | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Quarter Guard Street, Mamm | <Null> | <Null> | 106 |
| Ahmadu Abershi | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 82 |

1 (19 out of 653 Selected)

Parcel_Owners

Table Of Contents Table

Table

Parcel_Owners

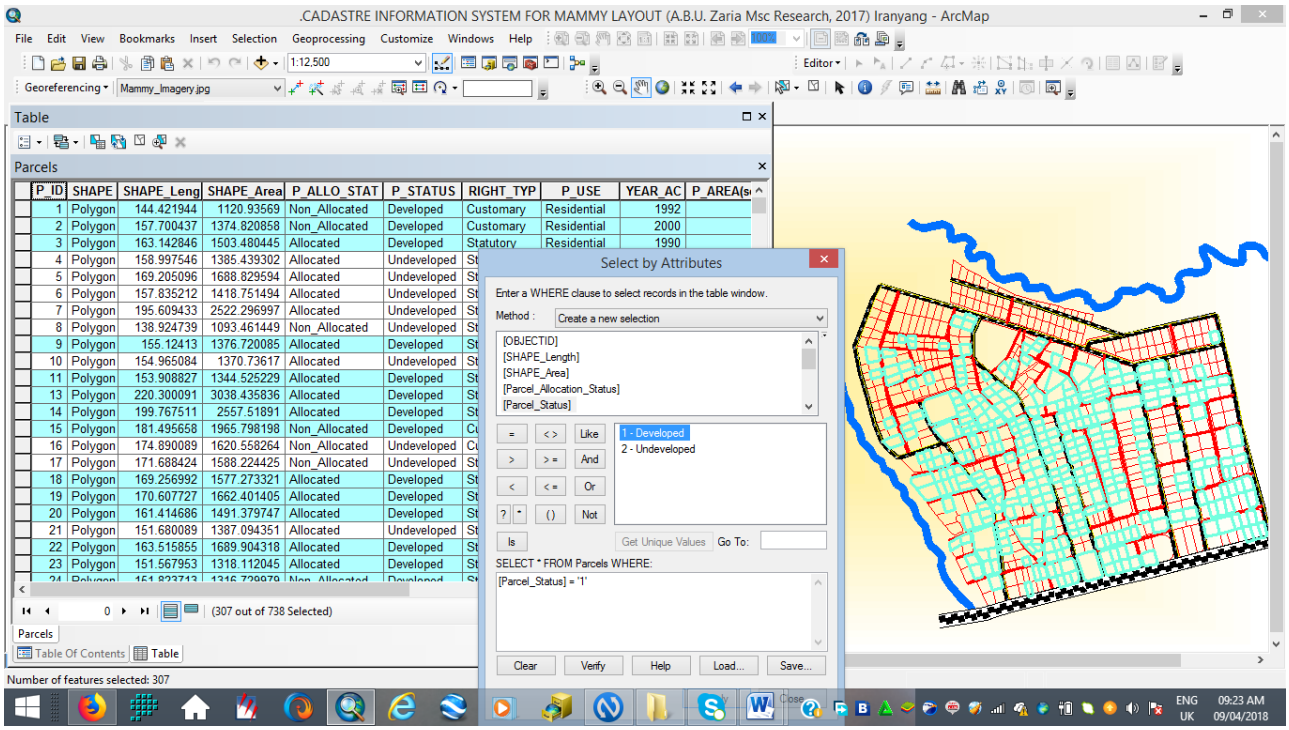
| OWN_NAME | SEX | OWN_OCCP | PHONE_NO | NATIONA | STATE | L_G_A | OWN_ADDRESS | NAME_OF_N_O_ | N_O_K_ADDRESS | OWN |
|---|---|---|---|---|---|---|---|---|---|---|
| Ahmadu Abershi | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 82 |
| Ahmadu Hamidu | Male | Bussiness | <Null> | Nigerian | Taraba | Takum | Sam Tsokwa Street, Mammy | <Null> | <Null> | 554 |
| Ahmadu Jerushah | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Calypso Street, Mammy | <Null> | <Null> | 677 |
| Ahmadu Kpambo | Male | Civil_Servant | <Null> | Nigerian | Taraba | Ussa | Bala Street, Mammy | <Null> | <Null> | 230 |
| Aishatu Aliyu | Fema | Civil_Servant | <Null> | Nigerian | Taraba | Donga | Unique Street, Mammy | <Null> | <Null> | 839 |
| Aishatu M. Jafaru | Fema | Bussiness | <Null> | Nigerian | Nasaraw | Nassarawa | Mammy Market, Mammy | <Null> | <Null> | 643 |
| Aji Angyo | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Ikam2 Street, Mammy | <Null> | <Null> | 568 |
| Aku David | Male | Civil_Servant | <Null> | Nigerian | Taraba | Taraba | Mammy Market, Mammy | <Null> | <Null> | 26 |
| Albert Tanko | Male | Bussiness | 07030790383 | Nigerian | Taraba | Takum | Ikam2 Street, Mammy | Rimamsanati Tank | <Null> | 506 |
| Alex Simon | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Divine Grace Street, Mammy | <Null> | <Null> | 178 |
| Alfred Ahura | Male | Civil_Servant | 07032224559 | Nigerian | Benue | Vani Kyaa | Sam Tsokwa Street, Mammy | Ezekiel Alfred | <Null> | 465 |
| Ali M. Kaku | Male | Bussiness | <Null> | Nigerian | Taraba | Takum | Angwan Lantang, Mammy | <Null> | <Null> | 808 |
| Ali Nzea | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Divine Grace Street, Mammy | <Null> | <Null> | 298 |
| Ali Tikichin | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Calypso Street, Mammy | <Null> | <Null> | 2 |
| Alidu J. Ekin | Male | Civil_Servant | 08169942929 | Nigerian | Taraba | Takum | Sam Tsokwa Street, Mammy | <Null> | <Null> | 241 |
| Aliyu Nama | Male | Bussiness | <Null> | Nigerian | Katsina | Funtua | Sam Tsokwa Street, Mammy | <Null> | <Null> | 456 |
| Aliyu Sunday | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Angwan Lantang, Mammy | <Null> | <Null> | 412 |
| Allahayi Patrick | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Standard Foundation Stree, | <Null> | <Null> | 483 |
| Aluku Gbako | Male | Civil_Servant | 08144885150 | Nigerian | Taraba | Takum | Mammy Market, Mammy | John A. Gbako | <Null> | 441 |
| Amaseh Nguter Simo | Fema | Applicant | <Null> | Nigerian | Taraba | Takum | Unique Street, Mammy | <Null> | <Null> | 625 |
| Ambikpu A. Uchen | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Sam Tsokwa Street, Mammy | <Null> | <Null> | 633 |
| Amen Emma | Male | Farmer | <Null> | Nigerian | Taraba | Takum | Bala Street, Mammy | <Null> | <Null> | 96 |
| Amen Friday | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Quarter Guard Street, Mamm | <Null> | <Null> | 302 |
| Amina Abah Genesis | Male | Bussiness | <Null> | Nigerian | Benue | Katsina-ala | Bala Street, Mammy | <Null> | <Null> | 857 |
| Aminu Amin | Male | Farmer | <Null> | Nigerian | Taraba | Ussa | Bala Street, Mammy | <Null> | <Null> | 316 |
| Aminu Mudera | Male | Civil_Servant | <Null> | Nigerian | Taraba | Takum | Angwan Lantang, Mammy | <Null> | <Null> | 596 |
| Amos Sunday | Male | Bussiness | <Null> | Nigerian | Taraba | Takum | Divine Grace Street, Mammy | <Null> | <Null> | 324 |

1 (19 out of 653 Selected)

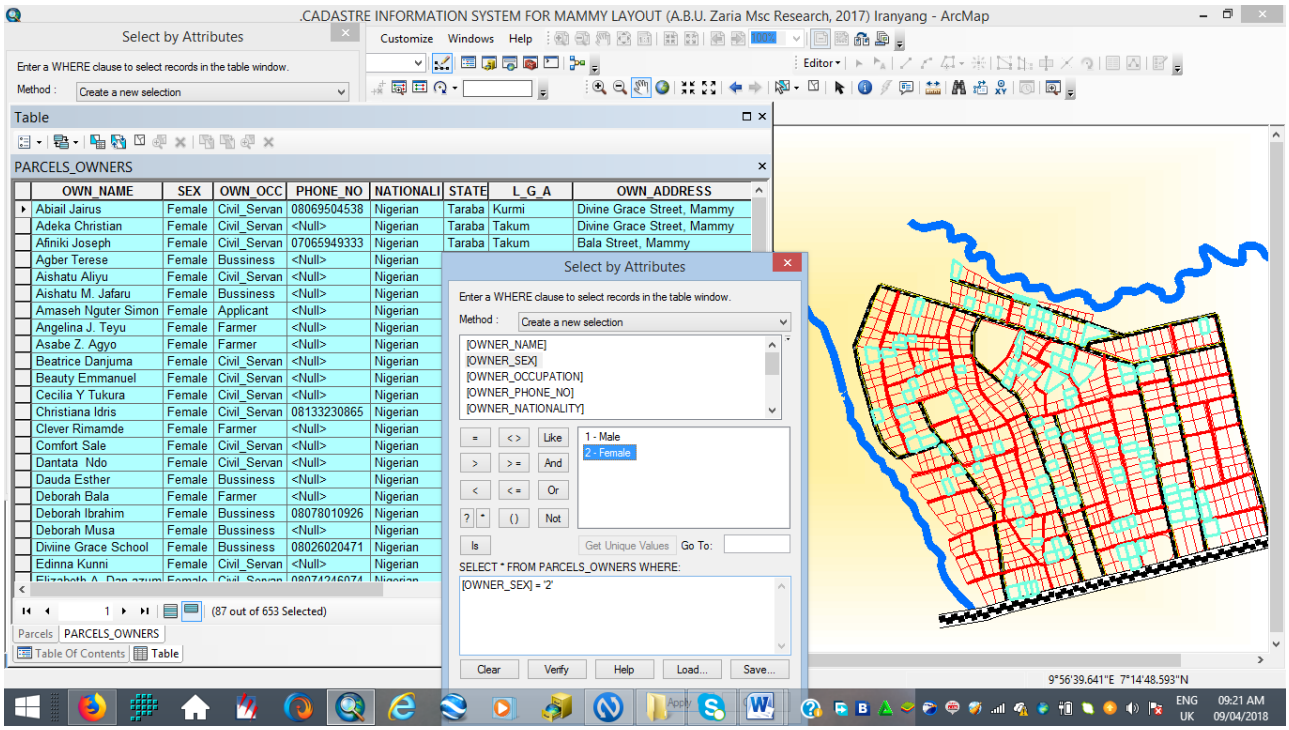
Parcel_Owners

Table Of Contents Table

# APPENDIX V: SCREEN SHOT OF CADASTRAL GEODATABASE QUERYING ANALYSES




**Queried Analysis on Parcel Status (Developed Parcel of Lands)**




**Queried Analysis on Female Parcel Owners and Parcels of Land Belonging to Them**