Application of Geospatial Techniques for Urban Land Records Management; Case of Werabe Town, SNNPRS

By: Rahmeto Mohammed Megenne

A Thesis Submitted to:

The Department of Geomatics Engineering

School of Civil Engineering and Architecture

Presented in Partial Fulfilment of Requirement for the Degree of Master's in Geoinformatics Specialization in Geoinformatics Engineering

Office of Graduate Studies

Adama Science and Technology University

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We, the undersigned, members of the Board of Examiners of the final open defense by Rahmeto Mohammed Meganne have read and evaluated his/her thesis entitled GIS based Urban Land Records Management: A Case of Werabe Town, Ethiopia and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement of the Degree of Masters of Science in Geoinformatics.

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I hereby declare that this MSc Thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

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To: department Subject: Geomatics Engineering Department Thesis Submission This is to certify that the thesis entitled GIS Based Urban Land Records Management A Case of Werabe Town, Ethiopia submitted in partial fulfilment of the requirements for the degree of Master's Geoinformatics Engineering, the Graduate program of the department of Geomatics Engineering, and has been carried out by Rahmeto Mohammed Megenne Id. No PGR/18258/11, under my supervision. Therefore, I/we recommend that the student has fulfilled Degree of Masters of Science in Geoinformatics. The requirements and hence hereby he can submit the thesis to the department.

Name of major Advisor	**Signature**	**Date**
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ACKNOWLEDGEMENTS

I would like to say thanks to Allah before anything who gives me full health, peace, knowledge and Wisdom to accomplish this thesis work. Next my wife Hayat Mohammed for her support throughout this endeavour. I would like to thank my academic advisor Roba Gemechu (PHD) for his guidance, constructive criticism and support through my work. I could not have completed this work without his input.

I would like to acknowledge Alexasander Girma and my friends for many interesting and fruitful discussions, and co-operation, for giving me a new sense of purpose. I would also like to thank the Geomatics Department at the University of ASTU. I sincerely appreciate everyone that assisted in making this work possible.

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LIST OF ACRONYMS AND ABBREVIATIONS

3D: Three Dimension

ASTU; Adama Sceince and Technology University

EA: Enterprise Architect

ELADM: Ethiopian Land Administration Domain Model

ESRI; Environmental System Research Institute

GIS; Geographic Information Systems

LADM: Land Administration Domain Model (ISO 19152:2012)

LRM; Land Records Management

LIS; Land Information System

MoUDC: (former) Ministry of Urban Development and Construction

MoUDH: Ministry of Urban Development and Housing

SAR; Systematic Adjudication Registration

UML; Unified Modelling Language

UN: United Nation

UPIN; Unique Parcel Identification Code

URA:. User Requirement Analysis

URPRIS: Urban Real Property Registration Information System

WLRM; Werabe Land Records Management

XML: Geodatabase Extensible Markup Language

ABSTRACT

Effective urban land records management is one of the most important elements to be considered in the context of urban development. All the elements for effective development depend upon an effective records management infrastructure. Most of the Ethiopian urban centres lack a comprehensive and well organized archiving system for the land records. The Werabe town municipality 2018 and 2019 annual and land inventory report documents stated that in the town land records management system are still dependent on the age-old methods of creating and maintaining the land records. Due to lack of proper land records management, poor records keeping, the poor inventory of land records, inadequate update of land information has resulted the problems such as; increases the chance to a bad management, acquisition, the manipulation of registration information, cumbersome technical and administrative processes, affect property transactions, violation of planning and building regulation, overlapping allotment of land, missing archive files and development of land related corruption are amongst some of the problems. This study would develop a geodatabase model using ArcGIS software to retrieve, update and store the required data. The designed model is validated and tested via sample data which can store, retrieve, and update the required data as per the user requirement. Developing this type of urban land records management system, therefore, facilitates and increases the efficiency of land registration and related activities at the municipality level. Thence, the town would be satisfied by the service delivery of the municipality. Furthermore, any spatial and non-spatial data related with the system can be stored in the database which will be ready for more analysis as to be able to use by policymakers, urban planners for the purpose of sustainable development of urban area infrastructural developments and land use policy. The research will lay ground for another task to develop 3D modelling for the study area thereby contributes to spatial data infrastructure development to Ethiopia.

Key Words: *GIS; Land Record Management; Geodatabase Design*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

The importance of land to the growth and survival of man can hardly be overemphasized. Land is indeed a very crucial resource to man as it provides the base for all developmental activities (Akeh, 2016). Land as an asset is unique because it is immovable, its value depends on its location and with growing population, and its demand keeps increasing, while its supply is limited. Access to land (or land rights) has a wide-ranging impact on livelihoods, industrial, economic, and social growth (Mishra, Suhag, 2017). Most cities and their surroundings have been expanding rapidly with the increasing rate of urbanization. With this rapid expansion, manual record-keeping has become inefficient, the vast amount of data is often daunting; time consuming and prone to abuses; which warrants the need for a better system of land administration and management practices (Ibrahim & Mansir, 2010). Lack of proper land records, poor records keeping and inefficient judiciary makes concerning system vulnerable to high loss and its demands a system that keeps the accurate record of lands and makes it available in time (Manjusha, Saharkar2, 2017).

Land records management deals with the detailed documentation in the form of survey, recording, processing, description and dissemination of information about ownership, value, use of land and its associated resources in support of land markets. All the elements for effective development depend upon an effective records management infrastructure (Aggarwal, 2014). Effective urban land records management is one of the most important elements to be considered in the context of urban development (Hirsi, 2015). As land holds importance in many spheres, it is required to have a system to gather, distribute and update information of land records (Manjusha, Saharkar2, 2017). Without reliable registers, transaction in land is often costly, time consuming, and uncertain. It is normally necessary to establish the fact that the reputed owner and trustee actually have the legal rights to deal with the property. Another difficulty being faced by many developing countries due the absence of the proper land records is the real land market. The reason may be unclear delimitation of individual or group rights, insecure ownership, etc. (Ali, Shakir, 2014).

Most cities and their surroundings have been expanding rapidly with the increasing rate of urbanization. With this rapid expansion, manual record-keeping has become inefficient, the vast amount of data is often daunting; time consuming and prone to abuses; which warrants the need for a better system of land administration and management practices (Ibrahim & Mansir, 2010). Lack of proper land records, poor records keeping and inefficient judiciary makes concerning system vulnerable to high loss and its demands a system that keeps the accurate record of lands and makes it available in time (Manjusha, Saharkar2, 2017). Its modern administration applying a spatial database system, therefore, is mandatory. The development of digital land records systems, and in fact, all digital cadastre related systems, is never a mere IT task. Where land registration has been predominantly paper-based, preconditions must be met before the digitalisation and system development can reasonably start (Helsinki 2017).

As is the case in many other African countries, the land records in Ethiopia is mostly kept in paper format and the information is generally unorganised, duplicated or out-dated. (Gertrude_Pieper 2017). Most of the city, urban land management, in Ethiopia is finding it increasingly difficult to cope with the demand for registering the process of land transactions as well as the rapidly changing patterns of land use associated with the accelerated urban growth. As a result of this, a number of other problems, such as inability to increase their revenue base, distortion of urban land market and delays in the implementation of urban development projects emerge. Moreover, the absence of reliable information especially land related is the most crucial impediment for the preparation and implementation of urban plans in many urban centres (Yehun, 2017).

The government of Ethiopia had been planning for the development of a national urban real property registration and information system (URPRIS) for some time, but an efficient land registration system could only be implemented when the existing situation had been clarified and the paper records had been digitised (Gertrude_Pieper 2017). Currently, the most practicing system to register urban land information is manual, which is hindered by enormous drawbacks for the management of the urban land administration. The experience in implementing the SAR in cities such as Addis Ababa, Hawasa, Adama, Hosana, Sodo, Bahir-Dar, Dessie, Debire-Markos, Arba-Minch, Dilla, Gonder, Debire-Birhan, Dire-Dawa and

Combolcha demonstrated that an existing paper file management digitizing program must be implemented in cities prior to SAR according to Ethiopian Land Administration Domain Model (ELADM) standard (Tula 2019).

Recently, new capabilities for data collection and processing, together with expanding requirements of users, have directed attention to the need for improved land Records management strategies (Patil 2014). Geographic Information System (GIS) therefore presents itself as a robust, reliable and versatile technology that can be used in managing land records (Akeh, Mshelia 2016). Geographical Information Systems (GIS) have the strength to handle large sets of georeferenced spatial data in a digital manner. The four components of a GIS are data capturing & preparation, data management, data manipulation & analysis and data presentation (Oud, 2017). Geographic Information Systems (GIS) have been used in various fields and disciplines to summarize and analyse spatial patterns and distributions, for the purpose of understanding how geographic and non-geographic entities interact with each other over space and time (Stephanie R. & Benno Staub, 2013).

As GIS and associated technologies mature and more data become available in computer form, the use of GIS for integrating land-related data becomes more opportune. Increased openness and integration of data are, however, more than technical issues and are often seen as a threat rather than as an opportunity (Dale and Mclaren). GIS platform offers in management of land records system over the present automated methods. Timely and easy access to accurate information on land records will facilitate easier, faster and more effective decision making. It will benefit all the stake holders including land owners, planners, policy makers and land administrators by the improved, effective and efficient methodology of land records management offered by GIS platform (Patil 2014).

Land records information has always been a vital part of local government operations, though historically undervalued and underused. To address this, ESRI developed the ArcGIS for Land Records solution, which uses common implementation patterns to form a complete geographic information system (GIS). For land records GIS is an effective tool. The ArcGIS® for Land Records solution is a complete geospatial platform for land records management. It is a modern, commercial off-the-shelf software solution that provides open, standards-based tools for implementing a sustainable, cost-effective solution to common local government land records challenges (Esri 2014). Thus, this study under take to give the possible recomendations about land records management by developing GIS-Based Geodatabase model for the Worabe town.

1.2. Statement of the problem

Most urban centres of Ethiopia have not been able to manage their scarce land resources through installing up to date land inventory as a prerequisite for proper land development and introduction of full-fledged legal cadastre system. All plots of land are not registered and hence there is no adequate database on urban land resource which is, indeed, the basis for almost all types of development intervention. Lack of proper land records, poor records keeping and inefficient judiciary makes concerning system vulnerable to high loss and its demands a system that keeps the accurate record of lands and makes it available in time (MoUDH 2016). Most of the Ethiopian urban centres lack a comprehensive and well organized archiving system for the land records. The files containing the documents of land parcels are poorly organized in the city archives. In some cases, even the basic documents as those showing the rights on the land are missing from the files (Yehun, 2017).

The Werabe town municipality 2018 & 2019 annual land inventory report documents also stated that in the town land records management system are still dependent on the age-old methods of creating and maintaining the land records. Due to lack of proper land records management, poor records keeping, the poor inventory of land records, inadequate update of land information has resulted the problems such as; increases the chance to a bad management, acquisition, the manipulation of registration information, cumbersome technical and administrative processes, affect property transactions, violation of planning and building regulation, overlapping allotment of land, missing archive files and development of land related corruption are amongst some of the problems.

In the Werabe town a current land records management practice also shows: absence of well-designed geo-database, there is no link between descriptive information and the spatial location, surveys to update land records have not been undertaken or completed, and maps have not been used to establish actual property boundaries on the ground. Therefore, in several records, the property documents do not match the position on the ground. The files whereby their location cannot be identified and they cannot be represented spatially. Urban landholding filing and file management system in the record offices are also very traditional and in poor condition. Landholding files are not in a secured condition and hence the existing file management system is exposed to different risks like inaccessibility, disappearance and loses of files. It becomes difficult and cumbersome to access land records and has not been updated. Hence, discrepancies are often noted in the land records. In general this system of manual surveys, non-uniform structures of record of rights, and a hard copy register create challenges to meet the objective of being an efficient one. Thus, this paper an attempt to closely evaluate the existing land record management and the adoption of geospatial techniques for efficient and effective urban land records management.

1.3. General and specific objectives of the study

1.3.1. General objective:

To develop geodatabase model for urban land records management in Werabe town.

1.3.2. Specific Objectives:

To achieve the general objective, the study has following specific objectives:

- To evaluate the existing urban land records management
- To illustrate requirements for urban land records management geodatabase model.
- To design urban land records management geodatabase model.
- To test the effectiveness of the developed geodatabase model.

1.4. Research questions

- What looks like the existing land records management practice in the town?
- What are the requirements to fulfill the needs of the town municipality?
- Which possible design is effective to develop an improved comprehensive urban land records management geo-database model?
- Which data are suitable to test the effectiveness of the developed geodatabase model?

1.5. Significance of the Study

Effective urban land records management is one of the most important elements to be considered in the context of urban development. Thus, this study under taken to give the possible solutions about land records management in Werabe town, it creates database and using for land records management. In addition it helps the town administrators to make rational judgment about the land records and eventually it contributes for its betterment. It may also be taken as a data source for further studies on this field. It is obvious that the researcher acquired more knowledge on the field throughout the process of the research.

1.6. Scope of study

The study involves development of a comprehensive geo-database model for the urban land records management in the Werabe town based on the data with land parcel as the fundamental unit and plot number as the primary key. The study also tried to have looked at the land records management practice of the town. But for the sake of the reliability of the study, the system of land registration currently in place and its associated challenges are investigated.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction

This chapter gives an theoretical review and empirical review overview of some important aspects such as significance of land, land administration system, land information system, land records management in Ethiopia and steps in geodatabase design/modeling among others, which are exploited in coming up with this study using data on land and land ownership to attain the set objectives. The details are under here:

2.2. Theoretical Review

2.2.1. Significance of Land

Land as an asset is unique because it is immovable, its value depends on its location and with growing population, and its demand keeps increasing, while its supply is limited. Access to land (or land rights) has a wide-ranging impact on livelihoods, industrial, economic, and social growth (Prachee, Suhag 2017). Land is indeed a very crucial resource to man as it provides the base for all developmental activities. Hence land plays the most crucial role for society's progress anywhere in the world (Aggarwal, 2014). Land is at the core of a nation's economy and as such it is essential to device methods for improving its management (Kurwakumire,2014). In most countries of the world, land constitutes a substantial portion of a nation's wealth (Akeh, ,2016). One of the most essential components of the socio-economic asset for Ethiopia is land, public property and not subject to sale, which is unbendingly administered and used mostly in the urban area (Abraham Kelilo Tula1, 2019). As land holds importance in many spheres, it is required to have a system to gather, distribute and update information of land records. Nowadays; everybody needs more detailed land information than it has been traditionally available (Dhote1, Saharkar, 2017).

2.2.2. Land administration Systems

Land administration is the way rules of land tenure are applied and made operational. There is great variety in the way land administration is implemented globally but typically land administration includes the functions of surveying and mapping, registration of property rights and property valuation (Dutta, 2013). Land administration essentially entails a number of processes meant at ensuring that land rights are properly delineated and recorded. It involves all those processes whereby information relating to land ownership, land use and land value are properly documented (Akeh, 2016). Most of the time land administration responsibilities are dealt with land delivering and transferring building permit, and tenure administration and documentation (Tula1, 2019). Sound land administration systems linked to geospatial data deliver a range of benefits to society in terms of: support of governance and the rule of law; alleviation of poverty; security of tenure; support for formal land markets; security for credit; support for land and property taxation; protection of state lands; management of land disputes; and improvement of land use planning and implementation (UN, 2015).

2.2.3. Land Information System

A Land Information System (LIS) is a computerized tool for legal, administrative and economic decision making (Pindiga, 2012). A land information system (LIS) is a computer based information system that enables the input, management, analysis, output and dissemination of spatially referenced, land parcel based data and information at mainly large (mapping) scales (Hirsi, 2015). Geospatial/land information and its management are fundamental to successful land administration and the derived benefits to the economies and overall sustainable development of nations (Experts, 2015). When data in the GIS is related to various quantitative and qualitative aspects of land resource, it is termed as Land Information System (LIS). LIS is most often based on the ownership, management, and analysis of portion of the earth most frequently of interest to human (Nahrin, Rahman). Due to rapid urbanization in Ethiopia, land datasets grow ever larger as populations expand and need for land information in support of development becomes ever more urgent (Ellis, 2019).

2.2.4. Cadastral System

A cadastre is a complete and up-to-date official register or inventory of land parcels in any state or jurisdiction containing information about the parcels regarding ownership, valuation, location, area, land use and usually buildings or structures thereon (Williamson). The International Federation of Surveyors (FIG, 1995) defines a cadaster as a "parcel based and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities) (Hirsi, 2015). A cadastre is normally a parcel based, and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, the ownership or control of those interests, and often the value of the parcel and its improvements (Ibraheem, 2012). The understanding of the cadastre and its potential has been continually altered due to dynamic humankind to land relationship and the consequent development of the cadastral science (Bennett, 2011).

2.2.5. Land Records Management

Land records management deals with the detailed documentation in the form of survey, recording, processing, description and dissemination of information about ownership, value, use of land and its associated resources in support of land markets. All the elements for effective development depend upon an effective records management infrastructure (Aggarwal, 2014). Effective urban land records management is one of the most important elements to be considered in the context of urban development (HIRSI, 2015). As land holds importance in many spheres, it is required to have a system to gather, distribute and update information of land records (Dhote1, Saharkar2, 2017). Without reliable registers, transaction in land is often costly, time consuming, and uncertain. It is normally necessary to establish the fact that the reputed owner and trustee actually have the legal rights to deal with the property. Another difficulty being faced by many developing countries due the absence of the proper land records is the real land market. The reason may be unclear delimitation of individual or group rights, insecure ownership, etc. (ALI, Shakir, 2014).

Most cities and their surroundings have been expanding rapidly with the increasing rate of urbanization. With this rapid expansion, manual record-keeping has become inefficient, the vast amount of data is often daunting; time consuming and prone to abuses; which warrants the need for a better system of land administration and management practices (Ibrahim & Mansir, 2010). Lack of proper land records, poor records keeping and inefficient judiciary makes concerning system vulnerable to high loss and its demands a system that keeps the accurate record of lands and makes it available in time (Dhote, Saharkar, 2017). Its modern administration applying a spatial database system, therefore, is mandatory. However, most municipalities are challenging in the administration of the land which is severely lacking consistent and automated land record systems which in turn result in a lack of transparency to the citizen. This potentially leads to corruption and informal settlement (Tula1, 2019). The development of digital land records systems, and in fact, all digital cadastre related systems, is never a mere IT task. Where land registration has been predominantly paper-based, preconditions must be met before the digitalisation and system development can reasonably start (Helsinki 2017).

2.2.6. Land Records Management in Ethiopia

As is the case in many other African countries, the land records in Ethiopia is mostly kept in paper format and the information is generally unorganised, duplicated or out-dated (Gertrude_Pieper 2017). Most urban centres of Ethiopia have not been able to manage their scarce land resources through installing up to date land inventory as a prerequisite for proper land development and introduction of full-fledged legal cadastre system. All plots of land are not registered and hence there is no adequate database on urban land resource which is, indeed, the basis for almost all types of development intervention. Lack of proper land records, poor records keeping and inefficient judiciary makes concerning system vulnerable to high loss and its demands a system that keeps the accurate record of lands and makes it available in time (MoUDH 2016). Most of the Ethiopian urban centres lack a comprehensive and well organized archiving system for the land records. The files containing the documents of land parcels are poorly organized in the city archives. In some cases, even the basic documents as those showing the rights on the land are missing from the files (Yehun, 2017).

The government of Ethiopia had been planning for the development of a national urban real property registration and information system (URPRIS) for some time, but an efficient land registration system could only be implemented when the existing situation had been clarified and the paper records had been digitised (Gertrude_Pieper 2017). Currently, the most practicing system to register urban land information is manual, which is hindered by enormous drawbacks for the management of the urban land administration. The experience in implementing the SAR in cities such as Addis Ababa, Hawasa, Adama, Hosana, Sodo, Bahir-Dar, Dessie, Debire-Markos, Arba-Minch, Dilla, Gonder, Debire-Birhan, Dire-Dawa and Combolcha demonstrated that an existing paper file management digitizing program must be implemented in cities prior to SAR according to Ethiopian Land Administration Domain Model (ELADM) standard (Kebede, Alexiussantion, 2019).

According to Tula1, 2019 the existing land information management system in Ethiopia can be generally identified as: The existing manual paper land registration system does not have secured access for different types of users and the data cannot be easily processed as per the required objectives, Information flow among different departments is restricted to manual information, This hinders the time and manipulation of data. The organized data recorded on paper does not have a basic relation between different data types (spatial and non-spatial data type), The existing system does not allow important and immediate information retrieval and report generation, Paper recorded data is not organized to attain data integrity, Parcel identification is kept in unorganized ways which prevents the acquisition of parcel information related with other spatial and non-spatial data and Data exchange among different departments about land registration is not consistent and standardized.

2.2.7. General Concepts of Geographic Information Systems (GIS)

GIS, technology began in the 1960s, computer systems based on hardware, software, and georeferenced data that can be used to collect, store, manage, process, analyse, and visualize both spatial and non-spatial information representing real-world geographic phenomena (Mitasova, 2008; Rogers & Staub, 2013). GIS is a system of hardware and software used for storage, retrieval, mapping, and analysis of geographic data. Spatial features are stored in a coordinate system (latitude/longitude, state plane, UTM, etc.), which references a particular place on the earth. Descriptive attributes in tabular form are associated with spatial features (Harris, 2014). A GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analysed (ESRI, 2018). Recently, new capabilities for data collection and processing, together with expanding requirements of users, have directed attention to the need for improved land Records management strategies (Yuvraj M. Patil 2014). Geographic Information System (GIS) therefore presents itself as a robust, reliable and versatile technology that can be used in managing land records (Akeh, Mshelia, 2016).

Geographical Information Systems (GIS) have the strength to handle large sets of georeferenced spatial data in a digital manner. The four components of a GIS are data capturing & preparation, data management, data manipulation & analysis and data presentation (Oud,2017). GIS technology is having capability of capturing, storing, analysing and displaying geographically referenced information which is needed in present scenario (Dhote1, Saharkar, 2017). Geographic Information Systems (GIS) have been used in various fields and disciplines to summarize and analyse spatial patterns and distributions, for the purpose of understanding how geographic and non-geographic entities interact with each other over space and time (Stephanie & Staub, 2013).

As GIS and associated technologies mature and more data become available in computer form, the use of GIS for integrating land-related data becomes more opportune. Increased openness and integration of data are, however, more than technical issues and are often seen as a threat rather than as an opportunity (P F Dale and R a Mclaren). GIS platform offers in management of land records system over the present automated methods. Timely and easy access to accurate information on land records will facilitate easier, faster and more effective decision making. It will benefit all the stake holders including land owners, planners, policy makers and land administrators by the improved, effective and efficient methodology of land records management offered by GIS platform (Patil, 2014).

Land records information has always been a vital part of local government operations, though historically undervalued and underused. To address this, ESRI developed the ArcGIS for Land Records solution, which uses common implementation patterns to form a complete geographic information system (GIS). For land records GIS is an effective tool. The ArcGIS® for Land Records solution is a complete geospatial platform for land records management. It is a modern, commercial off-the-shelf software solution that provides open, standards-based tools for implementing a sustainable, cost-effective solution to common local government land records challenges (Esri, 2014).

2.2.8. Geodatabase Model

A database is a collection of one or more data files or tables stored in a structured manner, such that interrelationships which exist between items or sets of data can be utilized by the database management system (DBMS) software for manipulation and retrieval purposes (Healey, 1991). The GIS database is similar to the conventional database. However, the ability of the GIS database to store, manipulate, retrieve and display spatial data (i.e. maps) in addition to the normal functions of the conventional database is the main characteristics that set it apart from other databases (Musa & Zemba).

A geodatabase is a geographic database hosted inside a relational database management system providing services for managing geographic data, such as; advanced editing features, validation rules, spatial database relationships, and topological associations (Benjamin, 2008). Geodatabase can be simple and hold basic information about a place, or very large and complex with varying information, layers, feature classes and datasets, raster's, and attributes.

It is the primary data format to edit and manage geospatial information used in a GIS (Ellis, 2019). A geodatabase is the collection of different geographic datasets within a common file system that can be used to store, query, and manipulate spatial data. The geodatabase stores a spatial reference system, attributes, geometry, and behavioural rules for data (ESRI, 2018).

A geographic data model is an abstract digital representation of real-world features. It provides the framework that allows spatial information to be accurately represented and analysed (Spring 2009). The geodatabase model implements smarter behaviour's into features, making them realistic to the real-world scenarios and easier to edit and manage. These advanced geodatabase features include attribute domains, subtypes, relationship classes, topology, geometric networks, and versioning (Tomlinson, Roger, 2007). ESRI identifies three types of geodatabases; File geodatabases – stored as folders in a file system, Personal geodatabases – datasets are stored within a Microsoft Access data file, and Enterprise geodatabases – known as multiuser geodatabases. The study will not discuss all type of geodatabases, instead focus on file geodatabase type solely needed for the study.

Table 1 Table 1 Comparing the three types of geodatabase

Key characteristic	**Enterprise geodatabase**	**File geodatabase**	**Personal geodatabase**
Description	A collection of various types of GIS datasets held as tables in a relational database (This is the recommended native data format for ArcGIS stored and managed in a relational database.)	A collection of various types of GIS datasets held in a file system folder. (This is the recommended native data format for ArcGIS stored and managed in a file system folder.)	Original data format for ArcGIS geodatabases stored and managed in Microsoft Access data files. (This is limited in size and tied to the Windows operating system.)
Number of users	Multiuser: many readers and many writers	Single user and small workgroups: many readers or one writer per feature dataset, stand-alone feature class, or table. Concurrent use of any specific file	Single user and small workgroups with smaller datasets: some readers and one writer. Concurrent use eventually degrades for large numbers of readers.

		eventually degrades for large numbers of readers.	
Storage format	• Oracle • Microsoft SQL Server • IBM DB2 • IBM Informix • PostgreSQL	Each dataset is a separate file on disk. A file geodatabase is a file folder that holds its dataset files.	All the contents in each personal geodatabase are held in a single Microsoft Access file (.mdb).
Size limits	Up to DBMS limits	One TB for each dataset. Each file geodatabase can hold many datasets. The 1 TB limit can be raised to 256 TB for extremely large image datasets. Each feature class can scale up to hundreds of millions of vector features per dataset.	Two GB per Access database. The effective limit before performance degrades is typically between 250 and 500 MB per Access database file.
Versioning support	Fully supported across all DBMSs; includes cross-database replication, updates using checkout and check-in, and historical archiving	Only supported as a geodatabase for clients who post updates using checkout and check-in and as a client to which updates can be sent using one-way replication.	Only supported as a geodatabase for clients who post updates using checkout and check-in and as a client to which updates can be sent using one-way replication.
Platforms	Windows, UNIX, Linux, and direct connections to DBMSs that can potentially run on any platform on the user's local network	Cross-platform.	Windows only.
Security and permissions	Provided by DBMS	Operating file system security.	Windows file system security.
Database administration tools	Full DBMS functions for backup, recovery, replication, SQL support, security, and so	File system management.	Windows file system management.

	on		
Notes	Requires the use of ArcSDE technology; ArcSDE for SQL Server Express included with • ArcGIS Desktop Standard and Desktop Advanced • ArcGIS Engine • ArcGIS Enterprise Workgroup • ArcSDE for all other DBMSs included with ArcGIS Enterprise	You can optionally store data in a read-only compressed format to reduce storage requirements.	Often used as an attribute table manager (via Microsoft Access). Users like the string handling for text attributes.

2.2.8.1. File Geodatabases

The file geodatabase provides a widely available, simple, and scalable geodatabase solution for all users that can work across operating systems. It can scale up to handle very large datasets and still provide excellent performance. File geodatabases also allow users to compress vector data to a read-only format that further reduces storage requirements (Esri, 2018).

File Geodatabase Structure/When to use Feature Datasets: Geodatabases are databases for storing feature classes, raster data, tabular data, tools for processing data, and other related elements for defining data's behaviour. A feature dataset can be seen as a sub-directory within a geodatabase to store feature classes and elements governing spatial behaviour. Feature datasets can be used to organise data, however, they also apply their spatial properties to their contents. All feature classes in a feature dataset will have the same projection, XY tolerance, and XY resolution. It is a good idea to store feature classes within a feature dataset to ensure that all feature classes share the same projection. It is required to store feature classes inside a feature dataset for applying topology rules to feature classes. All participating feature classes in a topology element must be stored in the same feature dataset. Tabular data, raster data, and toolboxes are stored at the base geodatabase level and cannot be stored inside a feature dataset (Esri, 2018).

2.2.9. Geodatabase Design Steps

Database design and creation is one of the fundamental processes in every GIS work executed. It is the process by which real world entities and their relationships are analysed and modelled in order to solve specific problems and find solution to questions of interest. A database is designed to service the need of a group of users. Such needs are called the information needs of the users or the user requirements. The heart of a geographic information system is a well-structured database i.e. spatial database. Database design is the process of identifying the data that will go into the GIS database and how it will be represented. A geo-database development process includes conceptual, logical, and physical design phases. Each of those phases ends in the creation of a product called a database model, i.e., a structural representation of some portion of the world. A database model is used to populate a database. GIS design involves organizing geographic information into a series of data themes—layers that can be integrated using geographic location. So it makes sense that geodatabase design begins by identifying the data themes to be used, then specifying the contents and representations of each thematic layer (Zeiler, 2004).

Geodatabase used to organize geographic data into a hierarchy of data objects; those data objects are stored in feature classes, object classes, and feature datasets. A feature class is a collection of features with the same type of geometry and the same attribute. An object class is a table in the Geodatabase that stores non-spatial information and a feature dataset is a collection of feature classes that share the same spatial reference. Feature classes that store simple features can be organized either inside or outside a feature dataset. Simple feature classes that are outside a feature dataset are called standalone feature classes. Feature classes that store topological features must be contained within a feature dataset to ensure a common spatial reference (Sherbrooke, 2008).

According to (HIRSI, June 2015) Database design is the process of identifying the data that will go into the GIS database and how it will be represented. The database forms the foundation of all activities that will be performed using the GIS, such as map creation, data retrieval and spatial analysis and modelling. A good database design results in a well-constructed, functionally and operationally efficient database that:

i. Satisfies user requirements and objectives

ii. Contains all necessary data but no redundant data unless some is explicitly planned for and properly documented.
iii. Has efficient data structures and retrieval mechanisms
iv. Supports maximum data sharing
v. Accommodates different user views of the data
vi. Is easy to update and maintain
vii. In summary, the process of database design consists of the following steps: Needs assessment, Conceptual design, Logical design, Physical design, Pilot implementation, and Full implementation and Operational GIS database.

A. Conceptual Design of the Database Model

According to ESRI, 2018 the objective is to determine the basic entities, the spatial relationships among the entities and the attribute of each entity that support the process and application for which the database is designed. Conceptual design is a modeling of the projected system that is independent of implementation of the data method that is to be used for the conceptual modeling and it must enable analyst to express the structure of information in the system (data type and relationship). It is an arrangement of human conception of reality and is decided by the human on how to present it in a simpler manner but still will satisfy information required of the GIS concerned. The products of a conceptual design stage in database design helps analysts and stakeholders carry out a discussion about what is the intent and meaning of the data that is needed to derive information, placing that information in the context of evidence and knowledge creation.

Identify the information products or the research question to be addressed; to the best information available, identify the information products that will be produced with the application(s). A GIS data designer/analyst would converse with situation stakeholders about the information outcomes to appear in the product, rather than guess at this. Sometimes such questions are called "need to know questions". For example, what do the stakeholders "need to know" about the geographical decision situation under investigation? What are the gaps in information, evidence, and/or knowledge? What information is not available that should be available in order to accomplish work tasks related to decision situations? What changes (processes) in the world are important to the decision situation? What are the decision tasks? Those are the information requirements.

Identify the key thematic layers and feature classes; A thematic layer is a superclass of information, commonly consisting of a dataset(s) and perhaps several feature classes (hence feature layers), convenient for human conversation about geographic data. For each thematic layer, specify the feature classes that compose that thematic layer. For each feature class specify the data sources potentially available, spatial representation of the class, accuracy, symbolization and annotation to satisfy the modelling, query and or map product applications.

Detail all feature class (es); for each feature class, describe the spatial, attribute, temporal data field names for the class. For each feature class specify scale range for spatial representation, and hence the associated spatial data object types? This will determine if multiple resolution datasets for layers are needed. Revisit step 2 as needed to complete the specification. Identify the relationships among the feature classes.

Group representations into datasets; A feature dataset is a group of feature classes that are organized based on relationships identified among the feature classes that help in generating the information needed by problem stakeholders. The dataset creates the instance of "thematic layer" or a portion of the thematic layer in which the relationships among feature classes are important for deriving information.

B. Logical Design

Data processing operations to be performed on the spatial, attribute, and temporal data types individually or collectively derive the information (from data) to satisfy step 1. Such operations clarify the needs of the logical design.

Define that attribute database structure and behaviour for features; Apply subtypes to control behaviour, create relationships with rules for association, and classifications for complex code domains.

Subtypes – Subtypes of feature classes and tables preserve coarse-grained classes in a data model; improve display performance, geoprocessing and data management, while allowing a rich set of behaviours for features and objects. Subtypes let an analyst apply a classification system within a feature class and apply behaviour through rules. Subtypes help reduce the number of feature classes and improve performance of the database.

Relationships – If the spatial and topological relationships are not quite suitable, a general association relationship might be useful to relate features. Relationships can be used for referential integrity persistence, for improving performance on-the-fly relates for editing, and joins for labelling and symbolization.

Define spatial properties of datasets; Specify rules to compose topology that enforces spatial integrity and shared geometry and specify rules to compose networks for connected systems of features and set the spatial reference system for the dataset. Specify the survey datasets if needed. Specify the raster datasets as appropriate.

Topology – Topology rules are part of the geodatabase schema and work with a set of topological editing tools that enforce the rules. A feature class can participate in no more than one topology or network. Geodatabase topologies provide a rich set of configurable topology rules. Map topology makes it easy to edit the shared edges of feature geometries.

Networks – Geometric networks offer quick tracing in network models. These are rules that establish connections among feature types on a geometric level and are different than the topological connectivity. Such rules establish how many edge connections at a junction are valid.

Survey data – Survey datasets allow an analyst to integrate survey control (computational) network with feature types to maintain the rigor in the survey control network.

Raster data – Analysts can introduce high performance raster processing through raster design patterns. Raster designs patterns allow for aggregating raster's into one overall file, or maintain them separately.

C. Physical Design

Data field specification; for data fields, specify valid values and ranges for all domains, including feature code domains. Specify primary keys and types of indexes.

Classifications and domains; Simple classification systems can be implemented with coded value domains. However, an analyst can address complex (hierarchical) coding systems using valid value tables for further data integrity and editing support.

D. Implementation and Populate the Geodatabase

Construct data schema to reside in a database management system. Test the computability of the data schema**;** what data do we have, what data are needed to create a module? How do you populate that geodatabase module?

2.2.10. Unified Modeling Language (UML)

UML (Unified Modelling Language) is a modelling language created by Grady Booch, James Rumbaugh, and Ivar Jacobson, and later standardized by the Object Management Group (OMG) in 1997. It consists of several concepts and notations used at different levels of abstraction throughout the system development and maintenance (Tuladhar, 2015). UML is a complete language for capturing knowledge (semantics) about a subject and expressing knowledge (syntax) regarding the subject for the purpose of communication. It applies to modelling and systems. Modelling involves a focus on understanding a subject (system) and being able to communicate in this knowledge. It is the result of unifying the information systems and technology industry's best engineering practices (principals, techniques, methods and tools). Modeling is the only way to visualize one's design and check it against requirements before developer's starts to code. (Kanwalvir Singh Dhindsa Himanshu Aggarwal, February 2011). Kanwalvir Singh Dhindsa stated that the land record information system is modeled using use-case, sequence, class, and component diagrams offered by the Unified Modeling Language.

2.3. Empirical literature review

ESRI is the leading provider of GIS software to land records, assessment, and cadastral agencies worldwide. ArcGIS and its extensions can help agencies meet their primary responsibilities of ownership registration, parcel mapping, real property valuation, and data access. ArcGIS provides the tools to more efficiently collect, convert, and improve map data; accurately assess properties; and provide Internet access to this data for the public, businesses and other organizations.

Modern GIS integrates various kinds of advanced, dynamic, multi-layered, time series data and graphical information which transform the tedious data analysis job to a faster, dynamic and realistic exercise. GIS technology helps in managing all aspects of land information and land records including land tenure, value, management, and use. With all land information in a GIS-based comprehensive land administration system, governments are able to improve land information management, property valuation and analysis, and communication with the public. The adoption of GIS for land administration purposes will undoubtedly bring a lot of benefits and promote sustainable national development in the country (https://www.google.com/).

According to Ellis, May, 2019 Successful Examples of GIS Applications; GIS was a key tool for locating playgrounds, facilities, or locations where elements specific for children's play were located. ArcGIS was used to map the locations of play spaces and analyse play in the city, along with the data management of the play areas. The City of Alexandria, Virginia successfully used GIS to conduct a study to improve access to public and semi-public play areas within the city. It will provide examples of using GIS to enhance the enjoyment of public places, increase productivity, and provide exceptional service to customers and co-workers. There will also be general benefits of GIS use across cities as a whole, not just focusing on one department. Being able to use GIS to help determine access to public facilities in a municipality is a great benefit to the community.

An article from ArcNews in spring 2017 describes the benefits and need for cities to consider geodesign when it comes to planning the future of their city. Geodatabase design combines the art of design with the science of geography. ESRI 2014 stated that ArcGIS for Land Records is a complete geospatial platform for land records management, offering a reliable, efficient path to better land records management. ArcGIS for Land Records meets those expectations by delivering the following advantages: Reduced costs, Expanded capabilities, Increased efficiencies, Reduced appeals, Help in finding new revenue, Improved data quality, Enhanced citizen experience with government and Improved government operations.

CHAPTER THREE

3. MATERIALS AND METHODELOGY

3.1. Description of Study Area

3.1.1. Introduction

Prior to establishment of the municipality and town administration the town passed through various kinds of administrative entities. During the imperial era it was administered by different governors known as Mislene. During the Derg regime, Werabe town has been administered by urban dwellers association (kebele) and after the Establishment of referendum that had been taken by Siltie nationality in April/23 1995 Werabe is selected to be the zone capital town. Soon after two years again in 1997 E.C. it became one of the reform towns in the region and acquired a town administration status.

3.1.2. Geographical Description of Study Area

Werabe Town administration is one of the 22 reform Town that is found in the SNNPRS (southern nation nationality and people of regional state) covering an area of 205 square kilometre. The town situated in North West of Hawasa city, capital of southern regional state 161 km distance, on the Shashamene to Halaba road and located on the main road from Addis Ababa to Hossana just 172KM apart from. Astronomically Werabe lies approximately between 7° ′48′04″ and 7° 55′15″ N latitude and from 38° 08′42″ to 13′42″ E longitude coordinates with an altitude of the town is found from 2080-2100 above sea-level with large plain land area. And the average annual there is no need a gap write it as one World rain fall is 1200 mm and annual Temprature is between 15-22 ^{o}c. it has Woina Dega climatic condition.

3.1.3. Population

Planning and implementation of any development program requires Information on the size of population, structure of population, distribution of population, population density, dependency ratio and demographic Dynamics in general. According to 1999 census, the population of the town Estimated to be 80642 of which 39561 were Males & 41081were females in 2011 E.C.

Location Map of Study Area

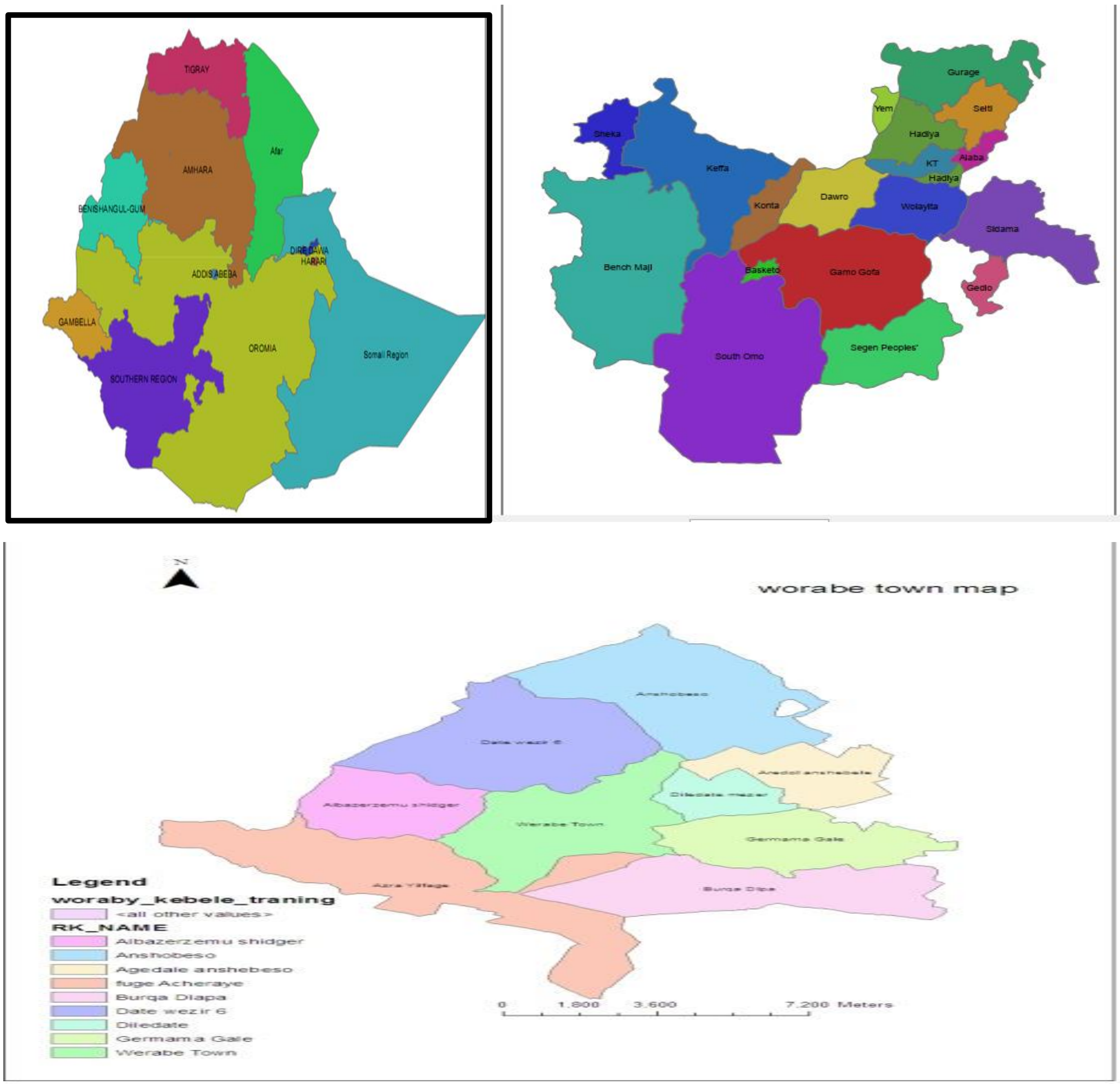


Figure 1 Location Map of the study area

3.2. Major Data Types and Data Sources

Two types of data were collected namely spatial data and non-spatial data.

Spatial data

Spatial data also known as geospatial data or geographic information refers to the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features, oceans, and more. Spatial data is usually stored as coordinates and topology, and is data that can be mapped. This type of data is often accessed, manipulated or analysed in a GIS environment.

Non-Spatial data

Non-spatial data also known as attribute or characteristic data refers to information that describes a geographic feature but do not have location information itself i.e. it is not directly related to a feature on the ground (it is independent of all geometric considerations). In GIS this data is usually stored in tables and linked to the feature by a unique identifier. It includes parcel ownership data, encumbrances, land valuation and taxation data, land statistics, land use types, soil types and its characteristics and site data. A key element of this dataset is the unique identifier that provides the linkage mechanism to the main geographic dataset.

Table 2 Data and Dataset used

Data type	Format	Source
Aerial photo of the Werabe town	raster	Town Municipality
GCP	point	Town Municipality
Landholding file Details	hardcopy	Town Municipality

Table 3 Software and Hardware used in processing

Software	Purpose
Enterprize architect 15	To develop and validate UML diagrams
Arcgis 10.8	Spatial and non-spatial data capture and analysis.
Microsoft Office word 2013	Report typing and editing
Toshiba lap top 8 GB RAM	To process office work and report writing

3.3. Methods

In order to achieve the objective of this study the following systematic steps was proceeded; present requirement analysis, assessing data and database design by different studies, geodatabase design phase, built geodatabase, primary and secondary data collected and populating, and test geodatabase of the WLRM by different scenarios was done. This study started with Different data collection to conduct the research thesis. Basically, two types of data were collected: The primary data include information obtained from officials and experts through discussions and interviews as the primary source; involve the use of User Requirement Analysis (URA). Whereas the secondary data include documents, reports, manuals and the Werabe town aerial photo. A requirement analysis followed by a design phase, Design and test of land records management GIS model in the most recent geodatabase format using all of its pertaining technical functionality. The first step is to assess the needs of the users (gathering user's requirement). This step is conducted by interviews and discussions with both the developers (producers) and end users.

The main priority is to design a proficient GIS model based on the needs of basic activity of data archive manual and ELADM. In addition to these different literatures, proclamations, rules, regulations, directives, standards of urban land administration and workshop presentations, seminars and reports were used. In addition to data, different software's were used to analysis different data to finalize this study. By using ArcGIS digitize the feature classes and Topologies were created for the parcels, Ownership Update, means of acquisition and Land use feature classes within the parcel feature dataset. These topologies indicate that parcels must be covered by blocks. Additional topologies were created for Subdivisions, with a rule that they cannot overlap. After creation of the test geodatabase, the feature datasets were added to include the features.

3.3.1. Requirement Analysis

Requirement analysis is the first stage in any designing phase for geodatabase. Prior to geodatabase design, requirement analysis was made and it was two folds. The first one is to identify the town municipality need and secondly data requirement of GIS is identified. As discussed in chapter two there are different methods of requirement analysis from those the study made through interview and observation for identification of the town municipality needs. Manager of the town municipality were interviewed using the interview questions prepared on the basis of the objectives of the study and problems town municipality is facing. Additionally, observation was made to identify the data management and handling system of the town municipality. On the other hand, data requirement of the GIS is made on the basis of the town municipality need. And, it involves; spatial reference and parcel features required in design for the GIS.

Geodatabase Design

In this study, Geodatabase design, was done on the basis of ESRI, through three phases; conceptual, logical and physical design phase. In conceptual design phase, the features classes required for the design are identified. Following, logical design phase was made and it involves identification of attributes with the associated domains for the features identified in conceptual design phase. Then, in Physical design phase ArcGIS workspace was created and in the workspace feature classes are established and their identified attributes and domains in the logical phase are implemented.

In the physical design phase, the procedure of building the geodatabase will be described in terms of applying the specifications identified in conceptual and logical design phase. ArcGIS workspace were created in EAUML diagrams, the datasets and feature classes were established and add to the corresponding datasets according to the structure mentioned in the conceptual and logical design phase. In addition the valid subtypes and domains were associated to the features; attributes and relationship were applied to the feature classes as well. Ultimately the UML diagram of ArcGIS workspace is validated, exported as XML schema, and imported to Arc Catalog. The model is diagramed using standardized database and geodatabase symbolization to assist the reader in observing basic components and relationships with in geodatabase.

Each phase in the development of the system was decomposed in to a number of components, each of which are designed and built separately. When the database designed and implementation steps is complete, the system partially used by the user. Thus, it will create acquaintance by system users. When deploying any new system, there is always a gap of misunderstanding the system. However, this kind of model is important to fill those barriers to deploy and use the system.

The general methodology adopted in this research is depicted here:

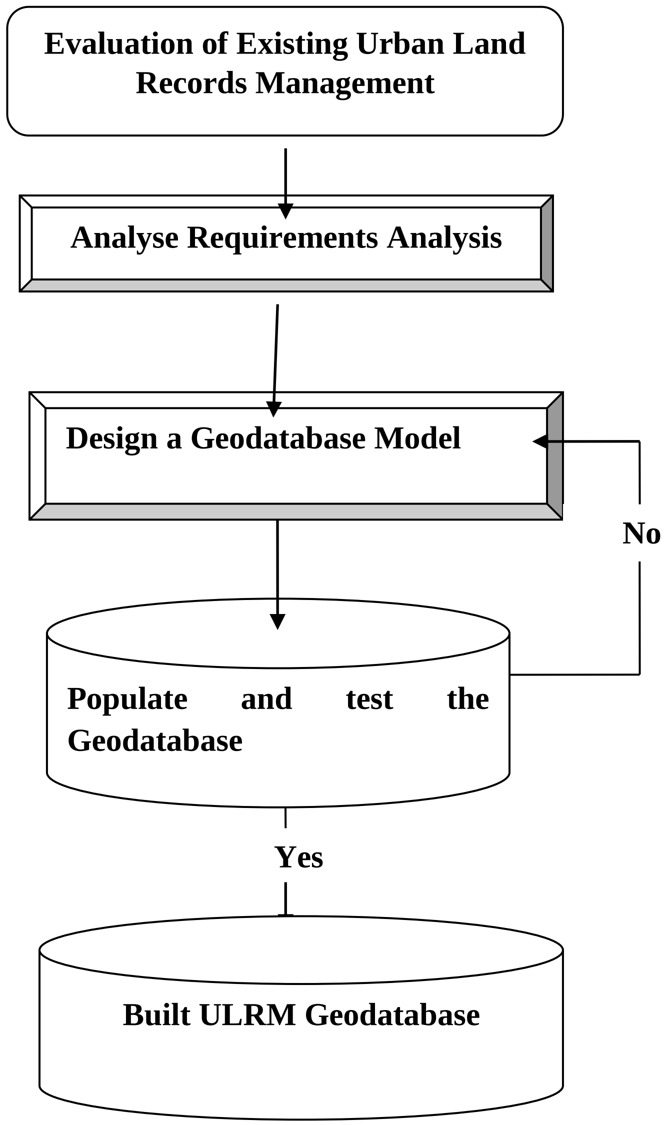


Figure 2 General Method of the Study

CHAPTER FOUR

4. DATA ANALYSIS, RESULTS AND DISCUSSION

4.1. Introduction

The research found the model for urban land records parcel unique identifier as the main required components for GIS based property tax information system development. From the details of owner information and parcel information were created. If the deeds registry is fairly complete, and there is adequate mapping of boundaries, a careful examination of the deeds may be sufficient to identify the parcels and their associated property rights. However, even when existing records are fairly complete, some fieldwork is generally necessary. But in the town municipality the adjudication process didn't undertaken through planned manner and the every land related activities were accomplished based on the office documents that were not well organized.

4.2. Data Analysis and Results

4.2.1. Evaluation of the Werabe Municipality Existing Land Records Management

The study assessed current land record management in terms of parcel related documents information, organization and time taken to access the file. At the time discussion with the municipal land development and management directorate head and officers; in the municipality the current land registration and recording practice is deed registration that means registering official copies of these records were kept in deeds registries. The municipality officers stated that in the municipality Land records were kept in hardcopy format in filing cabinets. The land records also organized with hardcopy based on title deeds registered in several books. In addition to books there was a tenure archive containing all documents relating to a property. The archive was indexed by kebele, village, block and plot number. The landholders data was found to be highly redundant, and in many cases, inconsistent. The municipality managers also confirmed the above stated conditions and said that this handwritten form of registration results the following errors these includes: Most of information occurs two to three times in the books, The inconsistencies and irregularities in the organization, violation of regulations, overlapping allotment of land, missing archive files, cumbersome technical and administrative processes.

During inspection of the archive files, the types of documents that occurred in the files were considered. A list of eight document types was proposed to MoUDH and it was agreed that these were the documents that needed to be and for which metadata had to be recorded into the system:

i. Registration of Allocation/Agreements:

Land acquisition by the community is taken place for different purposes like as a fixed property, gift or inheritance, as a human basic need, legal decision and so on. Means of acquisition is the most important document that testifies the legality of the possession of a land holding. Without it, it is difficult for a holder to make any claim. It is the responsibility of the municipality to prepare land to be allocated. The municipality didn't have the reliable information about the allocated land through freehold or lease hold system. During interview the allocated land that were done in the last 5 years were not properly registered and the officers said that we couldn't give exact figures about the allocated or transferred plots in the last 5 years. It is true that, in most cases legalizing existing old holdings are very difficult because evidences are not easily found. Thus the time needed to legalize such holdings depends on how soon one could proof himself or herself, however, failure to provide certificate of ownership has created insecurity of ownership for owners to transfer of sale property problems in the town.

ii. Registration of Sub-division:

In the recent past, it was possible to sub-divide a plot and transfer to another person through various ways of transfer like sale, gift, inheritance, etc. However, presently according to new economic policy of the country without any justification one cannot sub-divide and transfer a plot under one title. However, when the court approves a divorce and order a division of property between household and if the holding is dwelling unit and has an area more than $150m^2$ subdivision could take place and get registered in contrast to this, as officials and experts at the municipality agree sub-division of plots are done without the recognition of the municipality.

iii. Registration of Injunction/Suspension and Mortgages:

According to the Information gathered from the municipality through interview reveals that, in the municipality the mortgage registration process is time taking and is not effective. It is clear that the municipality gives a service related to registration of properties that are used as collateral to borrow money from financial institutions. Mortgages are accepted only if the properties to be mortgaged are free from any court injunction. All documents are to be submitted to the office accepting the mortgage. The land administration section which deals with land registration makes sure that the property inquisition free from any disputes and verities. The land development and management directorate officer of the municipality also confirms the procedure of mortgage registration process was lengthy and had many steps as well as the evidence collection process from the different sectors were challenged.

To approve the above mentioned pre-requests the customers are required to pass through the following steps; first the customer should go to kebele offices to get the evidence that shows the current status of the property. Second the customer should go to bank and other financial institutions to get the evidences that verify the land and property free from any collateral. Third the customers forced to go the court to get the evidence that approves the land and property free from any court injection. Finally the customer must be submitted to the municipality the above stated evidences and title deed, tax receipt etc… before mortgage registration. The customers stated that the mortgage registration process is very difficult and it takes above 4-5 weeks because in addition to the above mentioned steps the employee of municipality needs unnecessary benefits.

iv. Registration of Compensation and Valuation:

The assessment of property in the town does not determine in the current market price rather it is determined on the personal judgment of an experts. Moreover it does not consider or include the land value as well as a result the whole Procedure of assessing property and valuation being practice in the town is open for corruption. The compensation document serves as counter-check for land holders if they have been compensated for the parcel or not. This helps the right creator to verify that this has been enacted and precede the right creation without ambiguity. If there is a parcel that has been compensated but the land holder is still residing in the parcel, this has to be checked/ verified before offering a right to the land holder.

v. Registration of Land and Property Tax and other charges:

As any other town the Municipality of Werabe has been made responsible for other provision of certain municipal services. Finance is one of the key resources required to meet its obligations to this end. This resources can come from nowhere other than the town itself. Thus property tax, user charges, license fee income from municipal assets can be the some of the major source. Property taxation is under-utilized in Werabe Town because of the existing land registration and recording systems in account only land tax without considering the evaluation of possible future construction. Even though, revenue from property tax is the largest source in Werabe Town as any other town, The revenue is not collected efficiently hence the land records lacks completeness not revised time to time and one cannot easily identify the status of payment of each property owner.

vi. Land and property right transfer process:

Although the residents of the town could acquire land from the respected body, the municipality the land development and management directorate stated that the land right transfer process was not implemented as the rules or working manuals mentioned. The directorate officers also stated that the land transfer process needs repeated verification of old titles that was poorly organized in the municipality due to this reason and other constraints the procedure of land and property right transfer process was lengthy and had many steps.

vii. Building Permit process:

At the time discussion with the municipality manager, construction directorate head and officers they stated that the building permit delivery procedure was not implemented as the rules or working manuals stated. Although the documents of the land holders found in the municipality which organized with archives or books the applicant must submitted the evidences for the department. To get a building permit the applicant pass through the following steps: In order to erect a new building, to repairs an existing ones or to undertake major maintenance the applicant must present his /her application to either with the document include a site map showing the parcel, the building plan and the engineering estimates of the construction .Moreover in case to undertake major maintenance the applicant is required to present evidence that the holding is legal and that he/she is pay tax. The lengthy procedure and long-time delay enforces the land holders to construct illegally, as a result in most part of the town resulted sub-standard house. In addition the municipality loses its service charge and puts its burden on controlling construction.

viii. The updating mechanism of the land record:

As information obtained from the municipality cadastre office the land holders request update their documents with different causes then, in the office the applicant request doesn't easily performed. In general the updating mechanism in the municipality is very difficult because the parcels were not identified by aconsistent and unique numbering system thus links between the registry information and the parcels were unreliable. On the other side, according to Werabe town municipality experts, mechanism of updating system was inefficient and still now they didn't establish the proper system to the way of up-datedness. Moreover the registration processes were carried out with in a sub-section of land development and management directorate and simultaneous updating of land record was not carried out. The municipality also dessiminates the land information through hard copy which is not updated and it lacks completeness.This adversely affected the provision of reliable municipal services and land dispute prolems and it poses sociol problems.

In the municipality the land offices relied on landholders to submit their file. They would need this when registering a sale or inheritance, or another change in tenure. Without the file, it could take days, or weeks, to find the file. The offices did keep lists of names, addresses and file numbers, but these lists appeared to be out dated and unreliable. Sometimes, the files could not be found at all, in which case registration could not take place and landholders had to be sent away.

ix. Dissemination of Land Information:

As in general with in any specific governmental or non-governmental institutions policies, rules and regulations can be effective when there is an adequate institutional capacity in place. To assess this issue, the researcher tried to pinpoint the accessibility of land information of the town under study. Thus, according to the land administration department of the municipality, the problems that they are still facing day to day while carrying out the municipal land administration activities were lack of data capturing method about how much plots of land were owned by whom, shortage of finance to fulfil the necessary logistic materials for recording purpose, skilled and well experienced man power or professionals to facilitate and having the up-dated land information of the town's jurisdiction. This brings the weakness of the municipal as an institution and the municipality had no accurate and reliable land information. The situation made it difficult for land offices to answer basic questions such as: How many landholdings are residential and how many are commercial? How many title deeds have been issued this year? Which landholders have paid their annual land tax and which ones have not? Or even: how many landholder files are there in the town?

x. Cadastre practices of Werabe Municipality:

The interview made with the office head and experts in the Cadastral office indicates that there is no developed/organized cadastre system in Werabe town. The managers and officers stated that to start or implement the cadastre system in the town the poor land records management system of the municipality puts great effect; that is the pre-requests for cadastre development. Thus, the town does not have the cadastre system about the parcel of land in detail. As a result, land owners who occupy large area of land in the town are not paying proportional land taxes, many transactions (land and housing) in the town are taking place in the absence of registration of rights and issuance of certificates of tenure, and also there is sense of insecurity in the land owners. These and other related problems caused the town not to benefit from what it should deserve and to be short of financial strength to cover the cost of infrastructure and service provisions to the residents.

xi. Summary of the existing land records management in the municipality

The municipality the land records organization method is not efficient or the land records organized with hardcopy based on title deeds registered in several books. In addition to books there was a tenure archive containing all documents relating to a property. The tenure archive was indexed by kebele, village, block and plot number. The current land records organization method also didn't contain all necessary information about the parcels or property. The existing manual paper based land records management system does not have secured access for different types of users; the data cannot be easily processed as per the required objectives, The organized data recorded on paper does not have a basic relation between different data types (spatial and non-spatial data type), The system does not allow important and immediate information retrieval and report generation, Information flow among different departments is restricted to manual information. Thus, the municipality does not have the well-organized land records management system about the parcel of land in detail; they register the plot with only the owner name. Many clients were complaining about the process of service delivery to be time consuming and bureaucratic which is resulted from the poor and non-computerized documentation system.

4.2.2. Requirement Analysis

It is a pre-requisite to determining the requirement of the system before developing a model for urban land records management. The model is actually in designing the relevant database system which would handle specific requirements identified. One of the key sources to the analysis is the existed manual system documents which have been used currently for the urban land records management system. This step is conducted by interviews and discussions with both the developers (producers) and end users. The basic objectives of business analysis involve: Defining spatial reference system, Defining feature class and data Attribute, Describe and validating the data attributes, Assigning Unique parcel identification code and comprehensively documenting all of the requirements. Applying requirement analysis will significantly avoid the data redundancy and attribute coding inconsistencies issue that presented in the existing manual system.

a) Defining spatial reference system

Before a geodatabase can be designed for the WLRM, the basic spatial geometry of the geodatabase must be reviewed. The spatial reference is the geographic information including the projection or coordinate system and datum that the agency uses for mapping display. The urban land inventory manual adopted Universal Traverse Mercator (UTM) grid throughout the Ethiopian cities/towns (MUDHCo.2016). Thus, Ethiopia covered by three UTM zones, from zone 36 on the west 38 in the east, specifically Werabe town located in zone 37. Therefore, this study geodatabase design uses UTM grid specifically Zone 37 projected coordinate system.

b) Identifying data required to GIS Environment

The data required for GIS to design the geodatabase model are identified on the basis of the need and requirement to the GIS environment and availability in the organization land records data. This data involves land features and they are identified on the basis of ELADM (2016) and ESRI Data model. These data features of land in the Werabe town was cross checked and validated through onsite inspection during data collection. Moreover, those features that have to be included in the model according to the Land Archive standard(MoUDH, 2018) and

ArcGIS parcel fabric Data model, but doesn't exist in the study area are also included by considering the future demands. The land data features identified are presented in Table 4.

Table 4 Land data Features

Land Feature Data
Block
Parcel

Table 5 List of Attribute data

S/N	Attribute Data		
1	Owner_Name	12	Existing_Land_Use
2	Fathers'_Name	14	Actual_Area
3	Grand_Fathers'_Name	15	Title_Deed_Status
4	Kebele	16	Title_Deed_Area
5	Ketena	17	Title_Deed_Land_Use
6	Nhd_Id	18	Title_Deed_No
7	Block_Id	19	Building_Permit_Ref_No
8	Parcel_Id	20	Recipiet_Date
9	Aquisition_Year	21	Injuction
10	Means_Of_Acquisition	22	Mortgage
11	Agreement_Ref_ No,	22	Unique Parcel Identification Code

4.2.3. Design phases of the Geodatabase model

The design of a geodatabase is crucial to its success (Zeiler, 1999). According to Zeiler, you should identify goals, propose, analyze, evaluate alternatives, and create a plan to implement them. In this study, Geodatabase model design is done through three design phases and it involves; conceptual, logical and physical design phase. This was made on the basis of ESRI geodatabase model design. The details of these design phases are discussed in the consecutive sections.

4.2.3.1. Conceptual Design phase of the Geodatabase

Conceptual design phase is the research phase of designing a geodatabase model. In this study, all the requirements for conceptual design of urban land records management are examined and identified. It involves; classifying features based on understanding of the data required to support the organization's functions (i.e. defining geographic data entities) and deciding their spatial representation. This is done for data identified on the basis of organization and GIS needs and requirement identified in the requirement analysis.

a) Defining Geographic Data Entities

The geographic data entities required for GIS in designing geodatabase model are classified as feature class, which are presented in Table 6.

Table 6 Geographic Data Entity of Land Features Dataset

Land Features	**Geographic Data Entity**
Block	Feature Class
Parcel	Feature Class

b) Spatial Representation of Entities

For the feature class defined in previous section, they are further broke down into polygon based on their spatial representation of each feature class, presented in Table. The geographic data entities (Table 6) with their spatial representations (Table 7) are cross-checked with the ESRI parcel fabric to verify the defined geographic entity and the spatial representation and it is confirmed. Therefore, it is prepared for logical design phase in the consecutive section.

Table 7 Spatial Representation of Land Feature class

Land Features	**Spatial Representation**
Block	polygon
Parcel	polygon

c) Define entities and their relationships:

This is where feature classes and tables are defined, including relationship classes, domains, subtypes, and possible topologies. All feature classes will be placed in one feature dataset (Table) that were created for this study. At this time, based on discussions with the Town's GIS Technician, currently available data, and the needs of the Land development and administration Department, only one feature dataset was determined to be relevant/needed. As this concept expands to a Town wide GIS, additional feature datasets will be created to accommodate other department data. This step requires what data representations should be used; points, polygons, lines, raster data, etc. Points, polygons, and lines are all readily available for use and inclusion in the geodatabase to be created.

4.2.3.2. Logical Design phase of the WLRM Geodatabase

Logical modelling consists of the mapping of the conceptual design onto the logical model DBMS. Logical modelling comprises the design and normalization of the relational tables according to the entities, attributes and relations identified from conceptual modelling; several iterations will be necessary. It involves; matching the conceptual model to ArcGIS geographic dataset, determine geometry type of discrete features and implement attribute type for objects. So, in present study these are implemented in logical design phase for the feature classes discussed in conceptual phase.

d) Organizing into Geodatabase Structure

For implementation in physical design phase, the feature dataset and feature classes are organized into geodatabase structure.

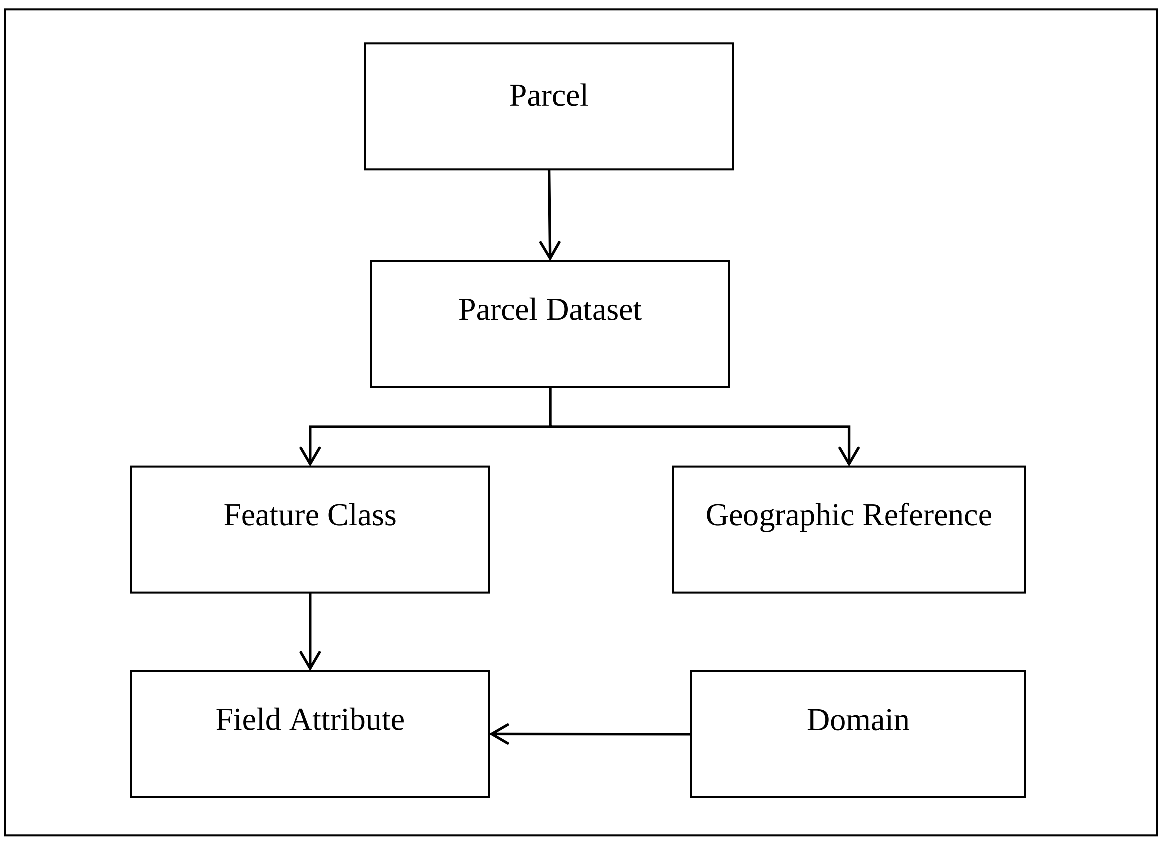


Figure 3 Structures of Logical design of parcel dataset

As shown in Figure 3, parcel dataset exists and these are included in feature datasets that store various feature classes. The advantage of having features datasets is it enables to have the same spatial reference for all feature classes. All the feature classes are included in the feature dataset and each feature classes have their own attribute with their associated domains. Therefore, the organization of the geodatabase into structure helpings during implementation in physical design phase.

e) Identifying Geometric Data Types and Attributes

The result of this logical design phase, which includes; attribute fields /field name/, data types, character size (length), associated domains, and field description are examined and here geometric network with other are identified. These attribute and associated domains identification was made on the basis of existing features in the study area and land records management standard manual.

Table 7 Geometry Type and Attribute of Parcel and Data Specification

S/N	Attribute name	Data type	Length	Domain	Description
1	Shape	geometry	-----	-----	Polygon (default)
2	Owner_Name	text	15	-----	Parcel ownership name
3	Fathers'_Name	text	15	-----	Fathers' Name
4	Grand_Fathers'_Name	text	15	-----	Grand Fathers' Name
5	Kebele	text	15	01,02,03	Name of Kebele
6	Ketena	text	10	-----	Name of Ketena
7	Nhd_Id	text	5	-----	Neighborhood Id
8	Block_Id	text	5	-----	Block Id
9	Parcel_Id	text		-----	Parcel Id
10	Title_Deed_Status	text	5	Yes/No	Title Deed Status
11	Title_Deed_No	text	15	-----	Title Deed reference No.
12	Title_Deed_Area	double	----	-----	Title Deed Area
13	Title_Deed_Land_Use	text	10	Land use type	Title Deed Land Use

14	Means_Of_Acquisition	text	15	Ethiopian land acquisition means	Means Of Acquisition
15	Aquisition_Year	integer	10	-----	Acquisition Year
16	Existing_Land_Use	text	15		Existing Land Use
17	Actual_Area	double	------	-----	Actual Area
18	Agreement_Ref_No	text	10	-----	Agreement Ref No
19	Building_Permit	text	15	-----	Building Permit
20	Injunction	text	10	-----	Injunction
21	Mortgage	text	15	-----	Mortgage
22	Recipient	text	10	-----	Recipient year
23	UPIN	text	15	-----	Unique Parcel Identification Code

Domains (Table 8) that associate attributes for the feature class is defined to use in attribute of the features. It offers a way to define a range of values that can be used for multiple attribute fields. Using domains helps ensure data integrity by limiting the choice of values for a particular field. The values of these attributes are known and they are defined at design stage (physical design stage), the user can select from these defined attributes during edition after population of features. For example, (Table 8 (means of acquisition)), when a user register parcel detail in the geodatabase model for means of acquisition, since they are pre-determined on the basis of existing list, it also used a user can simply select when implementing the design by the drop the down list when editing. Validation for these coded value domains is accomplished by restricting field values found in dropdown lists. This means a user can only select the defined values and can't add another values to the attribute under the domain type attribute field.

4.2.3.3. Physical Design phase of the WLRM Geodatabase

This is the design of efficient physical data storage structures for the data (e.g. arrays, trees, stacks, queues, etc.) where the data will actually reside on disc and also how the data may be efficiently accessed. The DBMS itself mostly handles this process. Physical modeling is both software and hardware dependent. The Physical Design involves the development of a geodatabase template that is a skeleton of the final geodatabase.

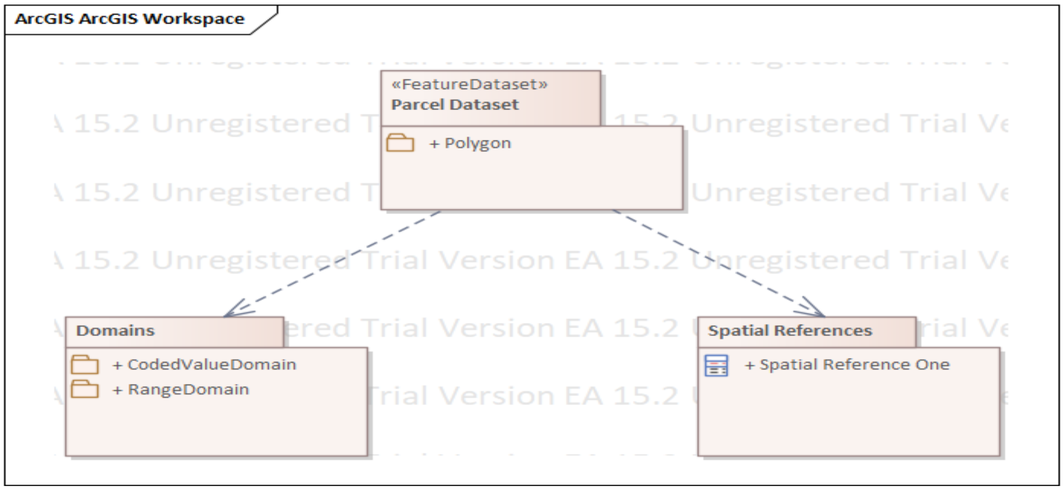


Figure 4 UML Physical Design Model of Parcel

In physical design phase, the logical data model design was implemented into actual design of geodatabase model. ArcGIS workspace was created in Enterprise Architect UML software and it includes; Feature dataset, Domains and Spatial Reference, presented in Figure 4. Under feature dataset, feature classes identified in conceptual and logical phase were established and the spatial reference described in requirement analysis was defined for the dataset. The Figures above illustrates the geodatabase model in its entirety. As identified under requirement analysis, conceptual and logical design phase, Figure 4 shows that creating ArcGIS workspace EA UML which contains feature dataset (polygon), domains (coded value, range) and spatial reference. Then, the identified feature class under logical design phase was entered UML with their geometric representation and their attributes. A spatial reference system was done according to the need of stakeholders which was discussed under requirement analysis.

f) Describe and Validating the Data Attributes and Domains

The geodatabase has several data integrity and data management capabilities including validation rules, subtypes, relationship classes, geometric networks, and so on. Attribute domains are a rule that describes the legal values of a field type. Multiple feature classes and tables can share attribute domains stored in the database Attribute domains are used to constrain the values allowed in any particular attribute for a table, feature class, or subtype. Each feature class or table has a set of attribute domains that apply to different attributes and/or subtypes. These attribute domains can be shared across feature classes and tables in a geodatabase. There are two different types of attribute domains: range domains and coded value domains. For this study used coded value domain. A coded value domain can apply to any type of attribute text, numeric, date, and so on. Coded value domains specify a valid set of values for an attribute. The coded value domain includes both the actual value that is stored in the database and a more user-friendly description of what that value actually means. Attribute domains are stored geodatabase wide. Once a user creates a new attribute domain, that user and all other users can view the properties of that domain and use the domain in a feature class or table. The study validate the required attribute fields the feature class as per needed. Domains coded used for attribute validation are adapted from urban land archive manual coding schema (MUDHCo.2018).

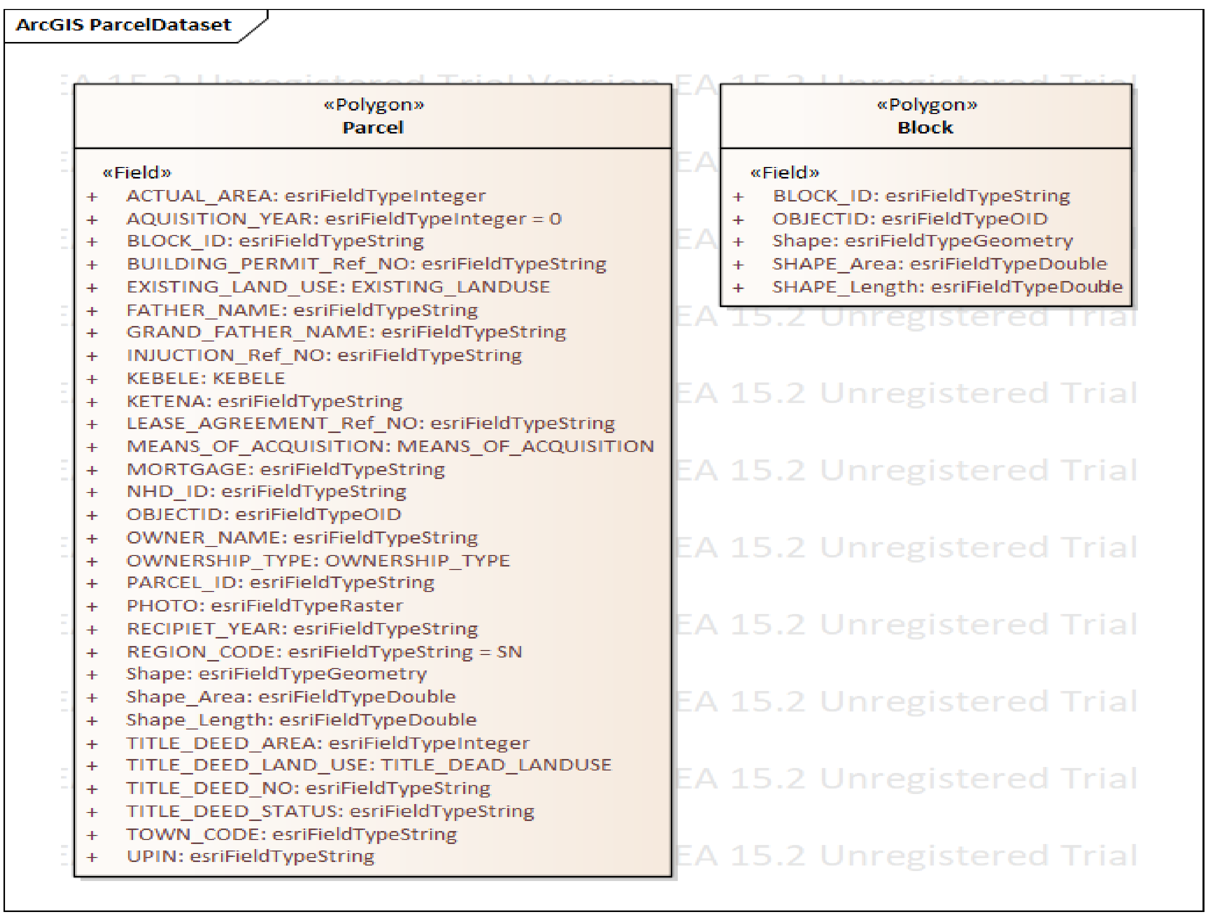


Figure 5 UML designed Parcel and Block Feature class with their Attributes

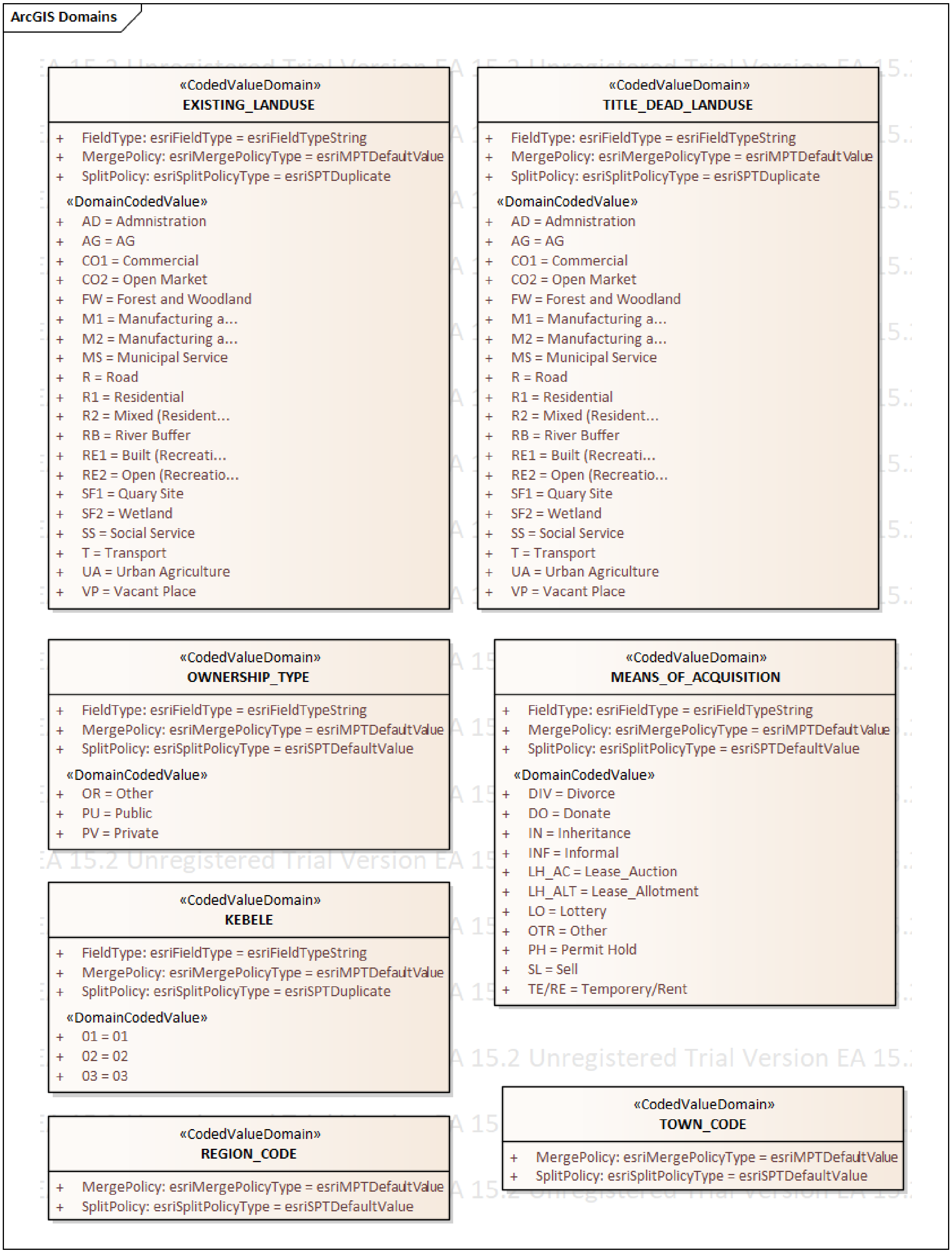


Figure 6 UML designed Domains of Parcel

In the above Figure 5 the geometric representation of Parcel is polygon. Positive (+) signs are public which was visible on ArcGIS attribute table. After assaying feature class geometric data type with the field attributes, length field type, and domain for their attributes in UML, it is validated to export into XML. The result of validated ArcGIS model is presented in Figure 6 below

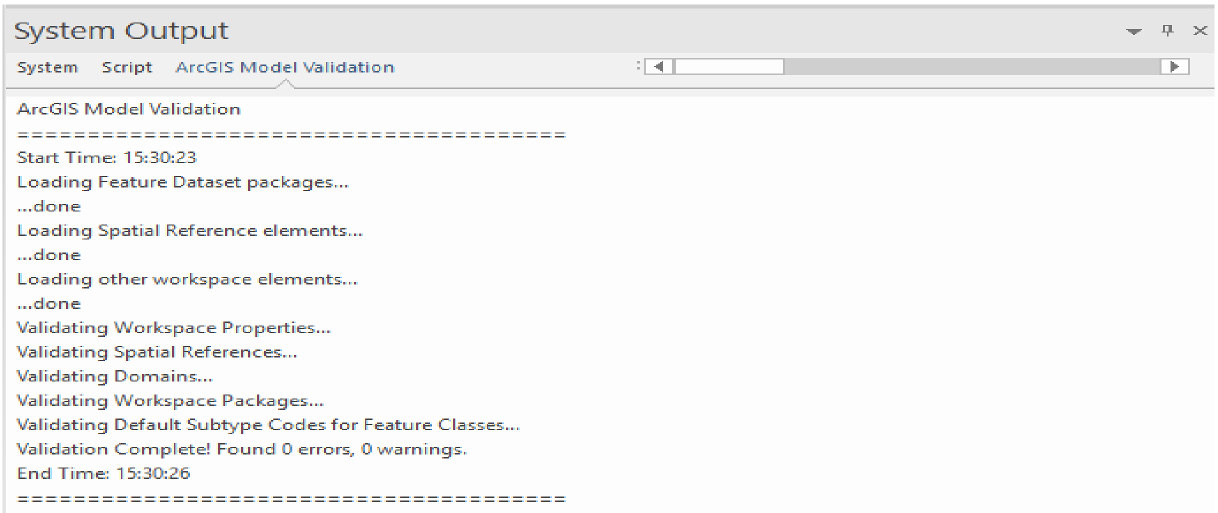


Figure 7 Validation Result of Designed UML

As figure shows Figure 6 EA validate spatial reference, domains, feature classes was completed Zero (0) errors and zero (0) warnings. The validated model was exported from UML diagram into XML scheme and XML scheme was imported into ArcCatalog and presented in Figure 8 below.

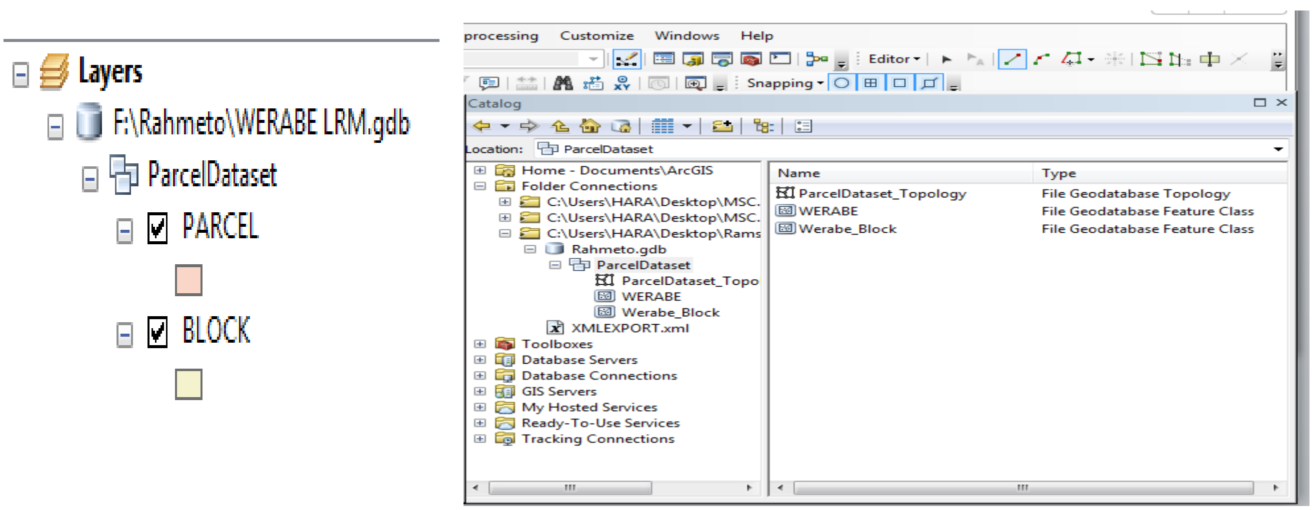
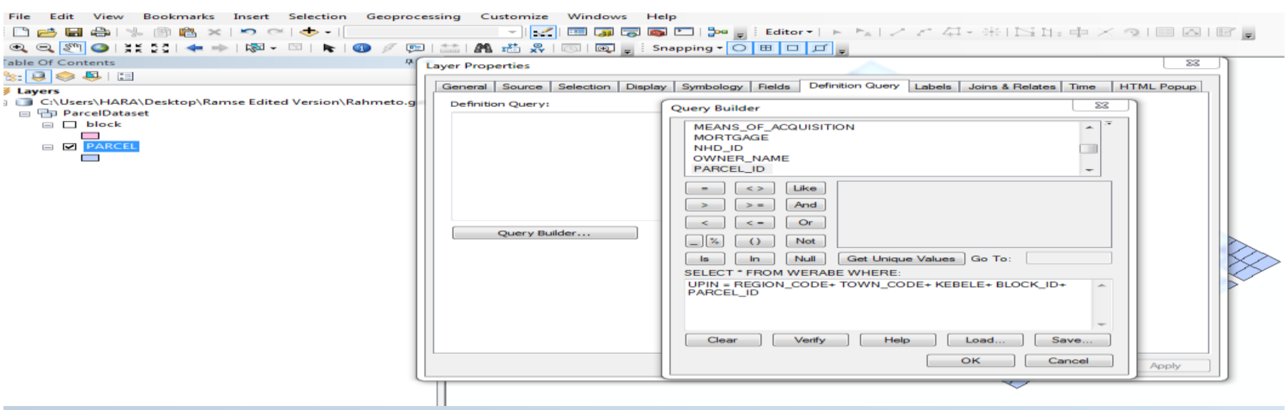


Figure 8 Designed LRM Geodatabase Model in ArcCatalog of ArcGIS environment

Database Query and Assigning unique parcel identification code: According to Urban Landholding Registration Proclamation No. 818/2014 Article 8, each parcel shall have a unique parcel identification code which may not be duplicated on another parcel in any urban centre. For this purpose the author used the ministry of urban development and housing urban land inventory manual (MoUDH 2016) to assign a code for each parcel. Therefore, the unique parcel identification code shall take the following form:

Region code + town code + Kebele Code + block number + parcel number build as follow

2 digits, type: Alphabetic+ 3 digits, type: Alphabetic+ 2 digits, type: numeric + 3 digits, type: numeric + 3 digits, type: number. Finally, a 13 digit unique parcel identification code will be generated by adding the above mentioned codes. For instance, a parcel found in Block 001 Kebele 02 of Werabe Town will have a code of: SNWER02001001. Therefore, with the same fashion, each parcel located in Kebele 02 and 03 of Werabe Town will have a unique parcel identification code.



TITLE_DEED_AREA	TITLE_DEED_LAND_USE	TITLE_DEED_NO	UPIN	Shape_Length	Shape_Area	OWNERSHIP_TYPE	TOWN_CODE	REGION_CODE
1400	Commercial	<Null>	SNWER0201001	164.743607	1587.050821	Private	WER	SN
2000	Commercial	<Null>	SNWER0201002	165.716208	1635.864693	Private	WER	SN
2000	Commercial	<Null>	SNWER0201003	175.4892	1895.205845	Private	WER	SN
1200	Mixed (Residential + other uses)	<Null>	SNWER0201004	147.018072	1221.365969	Private	WER	SN
2000	Commercial	<Null>	SNWER0201005	178.240375	1976.970194	Private	WER	SN
2000	Commercial	<Null>	SNWER0202006	185.611271	2152.106573	Private	WER	SN
1600	Commercial	<Null>	SNWER0202007	159.957168	1561.108159	Private	WER	SN
2000	Commercial	<Null>	SNWER0202008	188.688964	2222.831288	Private	WER	SN
2000	Commercial	<Null>	SNWER0202009	182.221685	2074.914558	Private	WER	SN
100000	Open (Recreation and Sport)	<Null>	SNWER0203010	1360.632526	115638.374435	Public	WER	SN
500	Mixed (Residential + other uses)	<Null>	SNWER0204011	104.596514	683.055061	Private	WER	SN
700	Residential	<Null>	SNWER0204012	108.744038	737.385664	Private	WER	SN
350	Residential	<Null>	SNWER0204013	80.587311	366.466168	Private	WER	SN
350	Residential	<Null>	SNWER0204014	80.972728	369.002935	<Null>	WER	SN

Figure 9 Assagigned Unique Identification Number

From this query, all the plots recorded in the database can be identified. Attributes related to the plot like, owner of the land, area, location and other details etc. can be collected. Therefore, it becomes easier for land records department to handle the records of land.

4.2.4. Populate and implementation of Geodatabase

File geodatabase was developed through conceptual, logical and physical phase described in previous chapter. So, in order to achieve the other objectives of the study, following model geodatabase development, the model is populated by using the prototype data to test the model for the intended purpose for which it is designed. These purposes involves; registration process, assigning unique parcel identification number and finding the required documents to test the time efficiency, it is populated as a prototype in kebele 02 around Werabe Hospital area of the town by using the data collected in the town Municipality and digitizing 24 block and 170 parcels. This area is used as a prototype on the basis of required and availability of spatial and non-spatial data for testing the model. To deliver customers' services provided by the municipality to check time taken this study populated into database model. In addition, the attributes and associated domains are also exist and imported to ArcGIS. Here the parcel features were presented in Table 8 below and the attributes for parcel features were presented in Figure 8 below as a sample.

Table 8 Features Present in Selected Prototype

S/N	Feature classes	Quantity	Amount
1.	Block	Number	24
2.	Parcel	Number	170

Table

PARCEL

OBJECTID	Shape *	OWNER_NAME	FATHER_NAME	GRAND_FATHER_NAME	UPIN	PARCEL_ID	BLOCK_ID	KEBELE	TOWN_CODE	REGION_CODE	OWNERSHIP_TYPE	AQUISITION_YEAR	MEANS_OF_ACQUISITION
158	Polygon	A/nasir	Jemal	A/selam	SNWER020100	001	01	02	WER	SN	Private	2010	Sell
159	Polygon	Negash	Aman	Kinfe	SNWER020100	002	01	02	WER	SN	Private	2006	LH
160	Polygon	Fereja	Hassen	Elboro	SNWER020100	003	01	02	WER	SN	Private	2006	LH
161	Polygon	Siraj	Shewmolo	Muze	SNWER020100	004	01	02	WER	SN	Private	2008	Permit Hold
162	Polygon	Mulege	Harun	Kemal	SNWER020100	005	01	02	WER	SN	Private	2006	LH
163	Polygon	Shemsu	Nesredin	Ahmed	SNWER020200	006	02	02	WER	SN	Private	2009	LH
164	Polygon	Mohammed	Kemal	Husen	SNWER020200	007	02	02	WER	SN	Private	2009	LH
165	Polygon	Tamrat	Getachew	Abebe	SNWER020200	008	02	02	WER	SN	Private	2008	LH
166	Polygon	Shemse	Keyre	Mosa	SNWER020200	009	02	02	WER	SN	Private	2009	LH
167	Polygon	Public	Public	Public	SNWER020301	010	03	02	WER	SN	Public	1999	Permit Hold
168	Polygon	Wesila	Sherefa	Essa	SNWER020401	011	04	02	WER	SN	Private	2000	Permit Hold
169	Polygon	Nursebo	Abrar	Hulchafo	SNWER020401	012	04	02	WER	SN	Private	1999	Permit Hold
170	Polygon	Werke	Abdella	Jemal	SNWER020401	013	04	02	WER	SN	Private	1999	Permit Hold
171	Polygon	Abrar	Behredin	Mosa	SNWER020401	014	04	02	WER	SN	<Null>	2002	Sell
172	Polygon	Tamrat	Bekele	Mesfin	SNWER020401	015	04	02	WER	SN	Public	0	<Null>
173	Polygon	Shulmitie	Hussen	Sheycho	SNWER020401	016	04	02	WER	SN	Private	0	<Null>
174	Polygon	Sule	Delcho	Shifa	SNWER020401	017	04	02	WER	SN	Private	0	<Null>

ACTUAL_AREA	TITLE_DEED_AREA	TITLE_DEED_LAND_USE	EXISTING_LAND_USE	TITLE_DEED_STATUS	TITLE_DEED_NO	LEASE_AGREEMENT_Ref_NO	BUILDING_PERMIT_Ref_NO	RECIPIET_YEAR	INJUCTION_Ref_
1587.050821	1400	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
1635.864693	2000	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
1895.205845	2000	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
1221.365969	1200	Mixed (Residential + other uses	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
1976.970194	2000	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
2152.106573	2000	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
1561.108159	1600	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
2222.831288	2000	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
2074.914558	2000	Commercial	Commercial	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
115638.374435	100000	Open (Recreation and Sport)	Built (Recreation and S	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
683.055061	500	Mixed (Residential + other uses	Residential	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
737.385664	700	Residential	Residential	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
366.466168	350	Residential	Residential	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
369.002935	350	Residential	Residential	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>

Figure 10 Results of Parcels attribute table

Find the Customer detail Information

To retrieve information from the database, SQL statements were used. SQL is a query language that enables data retrieval from relational databases. The syntax of SQL requires the specification of what attributes is to be retrieved, the relation involved, and any condition governing the retrieval. Such a condition is called a predicate. The results of the statement are a new drawing that is viewed in the database and also in the map face. However, the result are not stored in the database but used specifically for the purpose of visualization. One can prompt the software to save the query result. Queries are then run to get the desired information from the database. GIS applications are tools that allow users to create interactive queries, analyze spatial information, and edit data in Maps, and present the results of all these operations.

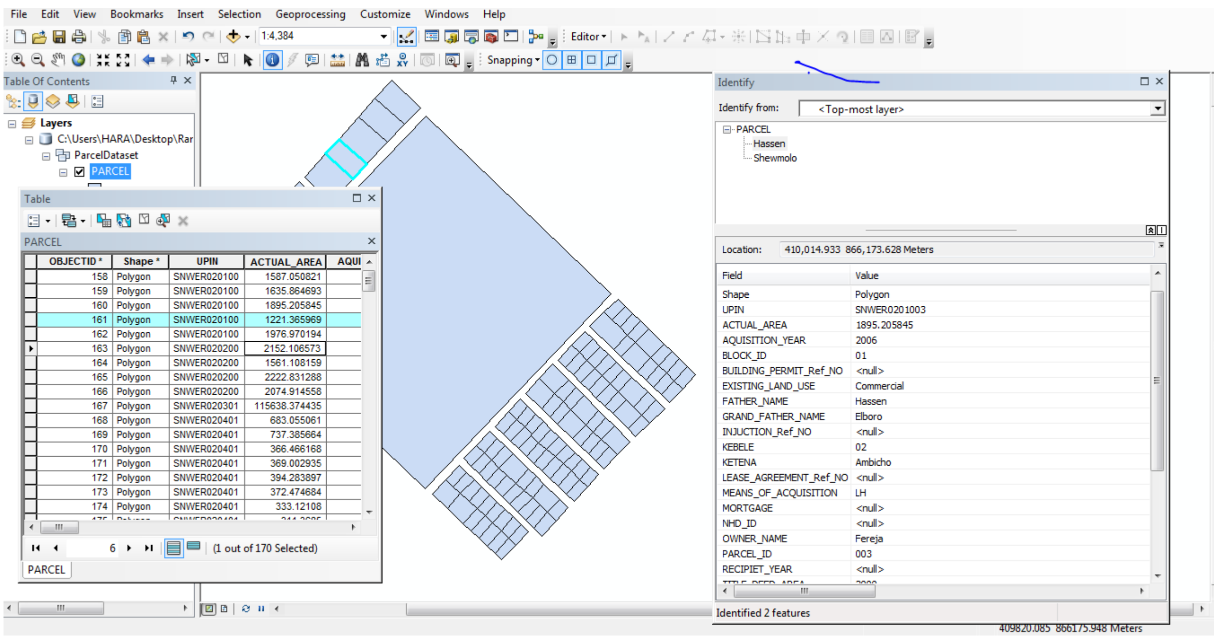


Figure 11: The Results of Ownership Detail Information

As shown in Figure, all the information of the parcel which is identified by UPIN reported as on which burst has displayed. This information includes all the attributes of that parcel. This enables the officers to easily access information's such as; where, what type of land use and its function, and other detailed information. This makes the officers advantageous in a way that it can fulfil the needs of its customer by taking immediate searched action. Therefore, having the developed geodatabase model in ArcGIS geo-database enables the officers and managers for management of records of the land easily and efficiently.

4.3. Discussion

This section reviews the work accomplished in this thesis, by examining the urban land records management challenges in the Werabe town municipality. The study research questions restated in order to verify the realization and state the discussion drawn from the associated research questions.

4.3.1. Existing Land Records Management

The vital point as in the system to established data bases for urban development activity and maintain up-dating and controlling the process at every time is very important for its sustainability. The land register, no matter how well it is established, loses its value when the land information it stores is not updated (Henssen, 2010). The information on parcels, rights and right holders keeps changing due to different reasons with or without rights transfer (Binns and Peter, 1995) argue that the failure or success of a registration system highly depends on the completeness and promptness in reporting changes in land information. (Mireille Biraro). As both land administration department members of the municipality that the researcher interviewed and the town municipality manager stated for the stakeholders the land information disseminated through hard copy and the disseminated information didn't updated due to weak land registration as a result the availability of land information for the stakeholders is not satisfactory. More on that, the system was not transparent and did not fulfil customer demand for reliable service from the land administration authority of the municipality.

The existing manual urban land registration system of parcels and its related data, however, were not easily identified by a unique numbering system, because manual registration usually keeps the record to the minimum via alphanumeric order. Thus, the proposed system will use a uniquely identified number which is an essential component for the development of the database. Due to manual record keeping of the database at the municipality record office, the administration of urban land and related activities are usually characterized by inconsistencies and irregularities among stakeholders which are a problem for the information come out from the system and a result of poor governance.

4.3.2. The LRM geodatabase design

ESRI identifies three types of geodatabases; File geodatabases – stored as folders in a file system, Personal geodatabases – datasets are stored within a Microsoft Access data file, and Enterprise geodatabases – known as multiuser geodatabases. This practicum was developing a file geodatabase system. ArcGIS is the software developed by ESRI that is used to create, manage, share, and analyse spatial data. The LRM geodatabase model was designed based on the ESRI's conceptual, logical and physical geodatabase design phases and applies them to Werabe municipality LRM geospatial data needs. The design elements presented here are original designs created solely for this thesis, the primary and ultimate goal is to design an efficient GIS for the Werabe town municipality to assist their LRM geospatial needs. A main component in this design was to identify the requirements of WLRM, and capture the data needs from the observation during the past implementation practice.

According to Tula1, 2019 In general, building a spatial database for urban land management information system provides for the municipality with the visualization of land related information and ready to use and implement land related municipal service delivery. This helps the municipality in providing better service delivery and as well helps for urban planners in making prominent and better decision making regards to modern urban land management system. In many cases, an automated and reliable urban land information management system is a key for enormous public development tasks. For example, land planning, infrastructure development maintenance; environmental protection and resource management are among the areas where the geoinformatics application system is crucial at large. Thus, by deploying urban land information management system at the municipality of the town, the data would be easily manageable and applicable. More on that, urban land registration, retrieving, updating at the municipality (user of the system) will drastically change the service delivery that will improve the satisfaction of the citizen in this regard Land in urban areas is an essential resource for every development activities.

System development technique applied in designing land records management system was the incremental build model which is a method of software development where the model is designed, implemented and tested incrementally (a little more is added each time) until the product is finished. It involves both development and maintenance. The system is defined as finished when it satisfies all of its requirements stated in the system requirement specifications. This kind of model is implemented and used iterative waterfall model.

4.3.3. Populate and implementation of Geodatabase

The above steps were followed to get the basis of the geodatabase and the information that would be included within it. The needs and data requirements listed above are sufficient to at least move the GIS capabilities of the Department in the right direction. The database is designed to incorporate the above requirements and relationships to better serve staff. Attributes and domains need to be updated and modified to provide accurate and usable information for the users.

A File Geodatabase was chosen and created using ArcGIS 10.8, From ESRI. Test data has been included to confirm the functionality of the geodatabase. According to ESRI, a file geodatabase can be edited by multiple users at the same time. This is possible if separate, stand-alone feature classes at the root level are being edited, separate feature datasets are being edited, or the same feature dataset but different feature classes are being edited. Though not ideal, given the current situation in the Land administration Department, only the author will have access to edit data within the file geodatabase.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Efficient and effective urban land administration depends on the availability of good, reliable and timely information. This information can be guaranteed through the computerization of land records using the GIS technology. The manual approach of keeping land records in most land registries in the country can no longer be sustained in this era of information revolution due to its inherent problems. It can therefore be concluded that in this study: In the introduction the shortcomings of manual record keeping were highlighted as well as the growing need for a computerized LRM as put forward. The results of the study have shown the importance of acquiring a computerized LRM for the Werabe Town Municipality. The objective of this study was to develop a Land Records management Geodatabase Model for the Werabe Town Municipality. In accomplishing the objective the specific objectives were set as follows:

i. To identify suitable spatial and non-spatial attributes about the land parcels through requirement analysis that should be included in the database.
ii. To design urban land records management geodatabase model.
iii. To populate and implement the operation of the database in the study area.

In this study, Werabe town urban land records management geodatabase model was developed. Suitable spatial and non-spatial attributes about the land parcels in the Werabe Town Municipality for inclusion in the database have been developed. The geo-database is developed through conceptual, logical and physical design phase. And, it consists of all the required land features as per the existing features in the study area and ESRI parcel data model. On the developed geo-database model Werabe land records management system were built. The result of the developed Werabe land records management system consists of necessary land features with the defined rule. The result of developed model implies that, it enables to store, manage, analyse, manipulate and display data that are linked spatially and attribute data (i.e. Land feature, data, and ownership detail, etc.). Also, it allows querying and retrieving information, and creating digital map for land records management.

The developed Werabe land records management system is tested through database queries and other analysis scenarios such as; identifying customer’s information to deliver service using data in selected prototype area. Therefore, the study concludes the developed model can be used for the whole Werabe town in the future for proper management of urban land records. It is also hopeful that implementation of this practicum will kick start the process for the town to further look into investing time and money to incorporate GIS town-wide, to benefit all departments and not just leave it up to individual staff in select departments to create maps on the fly with incomplete data. If Ethiopia is to achieve sustainable development, urgent steps must be taken to digitized its land records and build a national land information system or service that will foster the growth of organized land markets, guarantee tenure security, reduce land disputes and increase the revenue generating potential of government.

5.2. Recommendations

If GIS is to be successfully implemented for purposes of effective land administration in the study area as well as in Ethiopia, the following recommendations must be adhered to:-

This study recommends using the geodatabase model for the Town, to solve the Land Records spatial and non-spatial data management system. So, Werabe town municipality was the direct benefit from this study and the office can update their daily activities.

- The Town municipality can use the model to manage their land records in efficient and effective manners to deliver service and to keep the records in secure way.
- The Town municipality can use the developed model for land records management for the intended purpose for the whole Werabe town in the future.
- Finally, it is recommended that title documents emanating from the study in respect of land parcels should be printed on special security papers that will make it almost impossible to forge. By so doing, trust and confidence will be built in the system by all and sundry.

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APPENDIX- A: I znterview Questions

Interview to Municipal Land Management and Development Core Process

1. Position__________

2. Qualification__________

3. Profession______________

4. What is your view towards urban land registration and recording?

5. How do you manage land records (registration) in the municipality?

6. Do all land records have similar encoding mechanisms?

7. Does each land record have a unique parcel identification number (UPIN)?

8. What are the total numbers of recorded plots in the Werabe town?

9. What are the total numbers of owners with title deed, house owners who pay land tax and building tax, and those owners without any evidence?

10. What are the total numbers of plots who pay tax?

11. How many new plots allocated year to year? (By lease hold and permit hold)

12. How do you check those registration mortgages free of any problem like dispute problem title deed and verify all the evidences?

13. How do you register the sub divided plot and transfer to another person through various ways of transfer? (Sell, inheritance and a court approves a divorce and order a division of property)?

14. How long does it take to get a title deed certificate?

15. What are the total numbers of plots that have a building plan? From those plots how much plots have a building permission.

16. How much time was taken to get a building permit?

17. How do you describe the characteristics and procedures of land records management in the municipality?

18. Do you think the municipality current land records management is effective?

19. What are the major problems you faced and how did you tried to solve them in urban land records management?

20. Do you have any other recommendation about land records? __________________

Appendix Interview to Werabe Town Municipal Manager

1. Position

2. Qualification

3. Profession

4. What is your view towards urban land registration and recording?

5. What are your expectations from land records?

6. By what mechanism collect, organize and disseminate the land records in the municipality?

7. How do you describe the characteristics and procedures of land registration and property transfer?

8. Do you have appropriate land records management system and organizational structure for effective Land records management?

9. What are the major problems you face and how did you tried to solve them in land records management?

10. How do you see the project of cadastre and what do expect the benefits of the project over simpler registration and recording?

11. What are the major problems on the on-going cadastre project and what measure do you take to tackle the problems?

12. What is your long term plan? ____

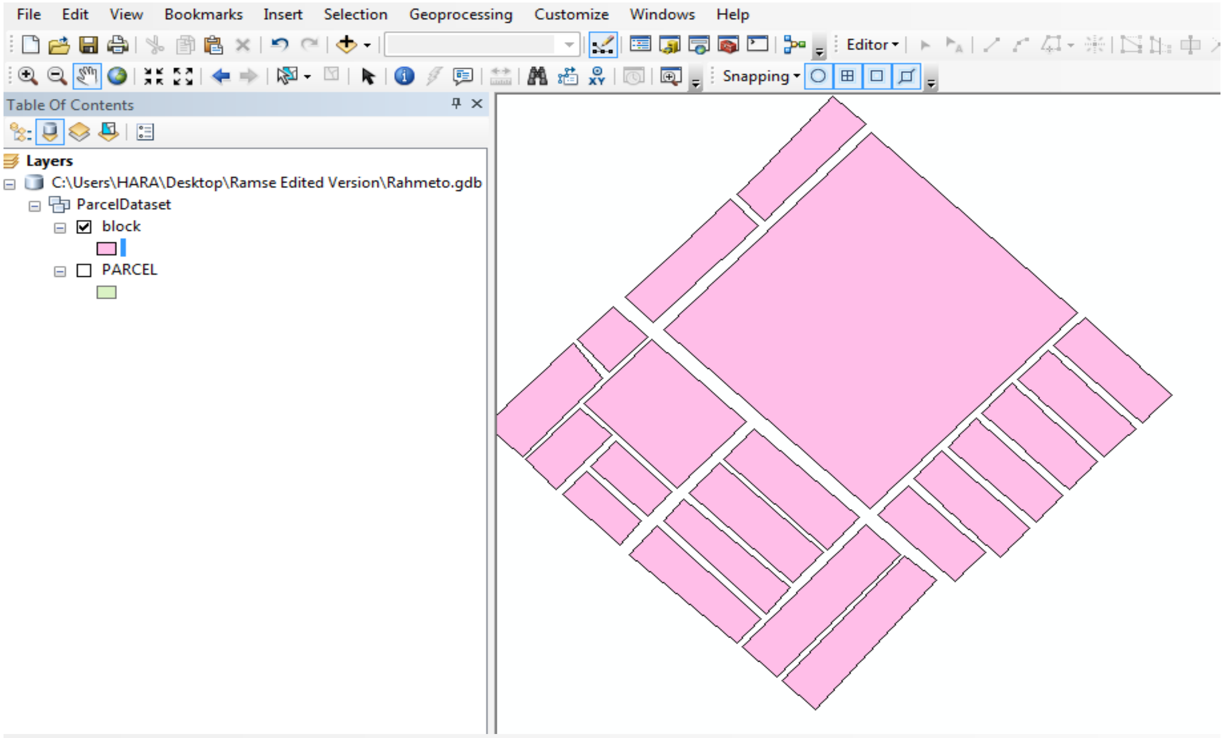
13. Do you have any other recommendation about land records? ____________________

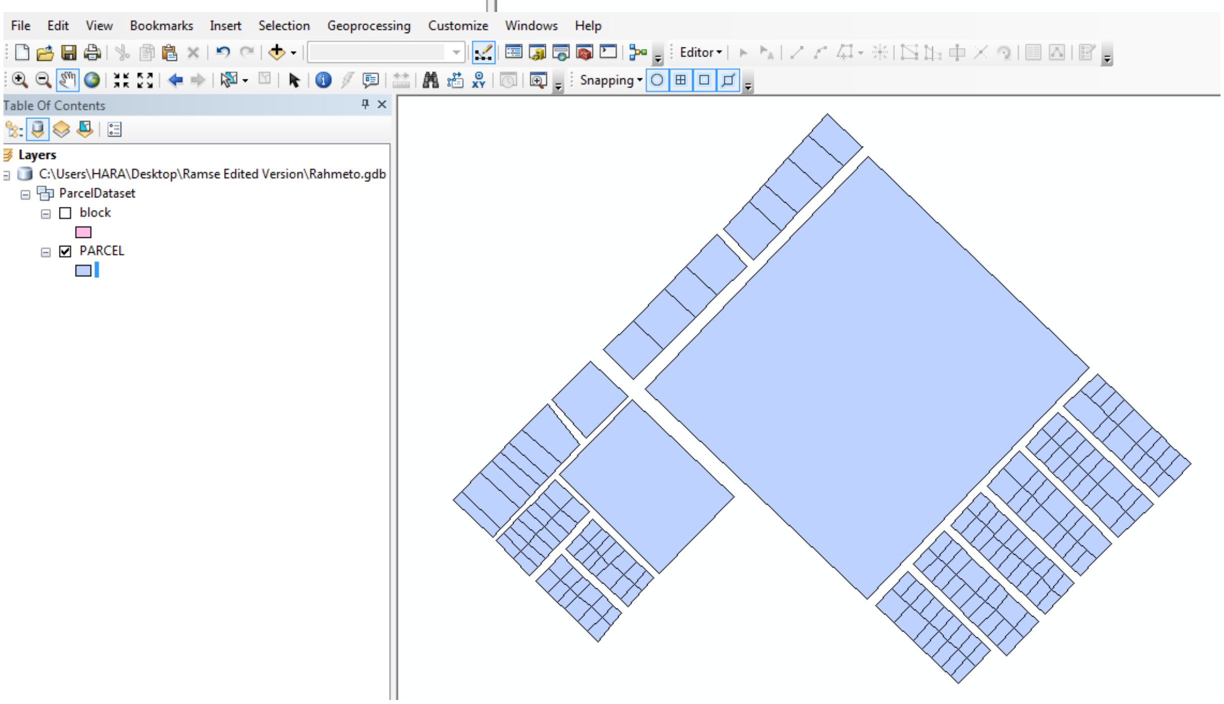
Appendix-B: The land use function, code and their description

Current Land use			
Code	**Function**	**Code**	**Function**
R1	Residential	RE2	Open(Recreation & Sport)
R2	Mixed(Residence + other uses)	FW	Forest & Wood land
AD	Administration	R	Road
Co1	Commercial(built)	T	Transport
Co2	Open Market, Livestock Market, Gulit	SF1	Quarry Sites
SS	Social Service	SF2	Other special functions as described below
MS	Municipal Service	UA	Urban Agriculture
M1	Manufacturing & Storage(Permanent)	AG	Agriculture areas such as Grazing land, crop land, and fallow land
M2	Manufacturing & Storage(Temporarily)	VP	Vacant place
RE1	Built(Recreation & Sport)	RB	River Buffer

Code	Function	Description
R1	Residential	Pure residential such as Residential houses, Kebele Residential, Municipal Resident houses, Rental House Administration, condominium
R2	Mixed(Residence + other uses)	Residential + commercial, Residential + Manufacturing , Residential + Storage, Reside uses
AD	Administration	Government & Non-Government Offices, police station, court, prison camp
Co1	Commercial(built)	Bank, Insurance, whole sale and retail shops, supermarkets, multipurpose building, F Hotel, Motel, Restaurant, Bar, Pension
Co2	Open Market, Livestock Market, Gulit	Open Market, Livestock Market, Gulit
SS	Social Service	University, Schools, Hospital, Health station, Clinic, Health post, Drug store/Pharma Mosque, Religious institutes, Religious (Muslim and Christian) Cemetery, Ritual sites
MS	Municipal Service	Abattoir, Solid & Liquid Waste disposal sites, Municipal Cemetery
M1	Manufacturing & Storage(Permanent)	Heavy and light industries, grain mill, Permanent building(Manufacturing, Warehouses/S depot
M2	Manufacturing & Storage(Temporarily)	Micro and Small scale enterprises build with temporarily material such as corrugate container, shade) which include Block manufacture, Metal work, Wood Work, handicraft
RE1	Built(Recreation & Sport)	Youth center, Resort, built indoor games, built Stadium
RE2	Open(Recreation & Sport)	Open Stadium, Open Playground, Park, play lot, Green Lot, Park, Community Greenery
FW	Forest & wood land	Forest, wood land, bush land, and Shrub land
R	Road	Roads of all types such as Arterial, Collector and Local roads
T	Transport	Taxi stop, bus stop, depot, terminals, driver training center, Parking lot
SF1	Special Function-1	Quarry sites
SF2	Special Function-2	Special Functions such as Military camp, Ammunition center, Wetland, High tension l station
UA	Urban Agriculture	Horticulture, Flower farm, Dairy farm, Beef farm, Poultry, Vegetable farm, Pig farm, Nur
AG	Agriculture Land	Agriculture areas such as Grazing Land, crop land, and Fallow land
VP	Vacant Land	Vacant Places
RB	River Buffer	River buffer area protected from development activities

Appendix Digitized Block and Parcel





Appendix Topology Rule