The Design and Implementation of Land Management Information System (LMIS), Bauchi State Ministry of Lands and Survey

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Abstract- The need to collection, store, process and disseminate information about land availability, ownership and titles is a fundamental task that should be performed by any responsible agency in charge of land administration. With the wide spread in ownership and use of Information Technological tools and techniques, it has become paramount to invest in the acquisition and use of technology for land management. It is in the light of this that this paper seeks to present the design and implementation of a software prototype for the Bauchi State Ministry of Land for the purpose of ensuring adequate and timely processing of land related transactions. The Structured System Analysis and Design Methodology (SSADM) which is a Software Engineering Methodology were used for the design and implementation of the prototype. Java programming language was used for the prototype coding with an underlying database implemented with MySql. The data for the system testing were collected using observation, interview and review of existing documentation. The results from the prototype show that land administration in its entirety can be done more effectively and efficiently and thus saving time and cost.

Keywords: Land Administration, Information Technology, Cadastral, GIS, LMIS

I. INTRODUCTION

1.1 Overview of Land Ownership and Administration

Land ownership from time immemorial has been treated as a measure of wealth, status and power all over the world. Because of this reason land has been the source of many bloody wars and dispute, not only between the nations who wanted to establish supremacy over each other but, also between common people, as this was the only source of their livelihood. It has been the cause of family rifts turning brothers into enemies. It has led disputes running through generations unresolved, attributed to lack of proper land management systems.

Land administration according to the United Nations Economic Commission for Europe (UNECE) is “the process of determining, recording, and disseminating information about ownership, value, and use of land, when implementing land management policies” [1]. Good land administration creates accurate, accessible, interoperable, timely, secure, and complete information about land and property in an affordable and efficient way that promotes confidence between the public, its commercial enterprises, and government. The records commonly held for land administration are also the foundation for integrated spatial information systems that link multiple users in the provision of government services by electronic means (e-government). They often provide the key data needed by all local and central government organizations and, to a lesser extent, by the public [2].

Therefore within every society there is a need for some form of land registration. In most developing nations it is difficult, extremely time consuming and financially costly to identify what land is available, its ownership, the rights and effective limitations to its use and its price as compared to similar lots; in order to accomplish its complete transfer to other users with clear title. Right to use land can be obtained through formal process of the law. In order to prove who holds the right to any particular piece of land, it is necessary to investigate the ‘title(s)’ which are normally kept in the land registry. But, the system being operated today in most Nigerian states, does not facilitate easy access to information on pieces of land with statutory right. The manual system currently in use today has become inefficient as a result of fast growing demand from variety of user(s).

From the 1970’s, most advanced countries has began to initiate some form of computer-based land information and mapping systems. This was important due to firstly, the many problems and constraints that emerged as a result of increasingly complex land ownership, tenure and registration issues as well as effective transfer of ownership (conveyance). [3]
Significantly, land administration information is providing fundamental reference information, such as property addresses and transportation networks, which enables the integration of wider spatial information systems managed by the public and private sectors. This integration facilitates the building of spatial data infrastructures (SDI) linking multiple users and allowing the delivery of a wide range of integrated e-government services.

![Fig. 1: Benefits of Good Land Administration](source)

Source: UNECE 2005

Fig. 1 shows examples of the benefits of good land administration (UNECE 2005), ranging from guarantee of ownership and security of tenure through support for environmental monitoring to improved urban planning, infrastructure development, and property tax collection. Agriculture productivity, though not explicitly featured, is also greatly increased where good land administration practices exist.

Land information system (LIS) has its roots in computer and database management. It is a computer hardware and software system design to permit an end user to input, store, manipulate, and display referenced data. It contains procedures for analyzing combinations of attributes and generating output. Therefore, it allows users to effectively organize, update and query land related data organized in a structured form within a data repository.

All Land Management Information System (LMIS), as in any GIS application, basically consist of the following:

- Data acquisition subsystem: this consists of all the hardware, software, procedure and personnel required for the acquisition of spatial data relating to the cadastral system.
- Data management subsystem: consists of the hardware, software, procedure and personnel required for the storage, manipulation, retrieval and display of the structured cadastral data.
- Data presentation subsystem: consists of the hardware, software, procedure and personnel required for the presentation of the land management information system from the database.

Bauchi state inherited the manual cadastre, for over 30 years the system has been the same: Application for statutory right of occupancy is done in triplicate which requires the same storage facility for each and a copy of whatever action is taken on the application has to be filed in each of the three files. As a result of developments over time, demand for good titled land has been on the increase. These titled lands may be obtained by direct application to the government or through the process of transfer of right from one person to another. The process of land conveyance is often delayed due to lack of instantaneous and reliable information on the cadastral system which in turn adversely affects development. This conforms to the observation made by [6] that:

1. Most African countries and many other developing countries do not have Land management information system using (LMIS)/GIS as a management tool. They either do not exist or are seen as too expensive.
2. Cadastral systems, generally in manual form, with incomplete coverage, are supplying most of the available land information. No alternative source of comprehensive information on land.

The approaches and difficulties associated with most cadastral systems have a direct effect on the quantity, quality, timing and type of information available to prospective land user(s). In Nigeria and well as most of the developing countries, land administration techniques are weak, and are prone to a number of problems namely:

1. General lack of technical, human and financial capacity throughout Africa.
2. “If no dispute occurs, the process of land registration takes an average of 15 to 18 months. This lengthy procedure means that tens of thousands of land title are usually pending”
3. “Most developing countries have an excessively large number of institutions involved in land administration and information flow, which give rise to over-lapping responsibilities”.

[6, 7]
1.2 Overview of GIS

From early days of civilization, human activities have always depended on Geographic Information. The decision makers and planners have always needed locations, qualitative and statistical information regarding various disciplines for planning, execution and control of various types of socio-economic development projects.

The advancement in computer and space technology greatly improved methods of information gathering, storage and dissemination. It brought Geographic Information System into the fore. GIS integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS enable users to view, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.

Sees GIS as a computerized tool for capturing, storage, checking, integrating, analyzing and displaying data which are spatially referenced to the earth. It is normally considered to involve a spatially referenced and structured digital database, and appropriate application software. The GIS tool is versatile in application through its various sub-sets e.g Land Information System, Utility Information System, Environmental Information System etc.

GIS can be said to be the art, science and technology dealing with the acquisition, storage, processing, presentation and dissemination of geo-information. In another word, it is a configuration of hardware and software, communication networks and analytical procedures for the extraction of information from data to support decision making so as to achieve managerial objectives. Land Management Information System is a tool not an application in itself. This tool provides function to digitize or scan data to design and build databases. Land information refers to any physical, legal, economic or environmental information or characteristics concerning land, water, groundwater, subsurface resources, or air in the state. Land management information has been used in a variety of systems over the years; from register of deed, tract indexes to surveyors tie sheets or soil surveys. Today many organizations are moving land information into Geographic Information System (GIS). A Land management Information System (LMIS) is similar to GIS but is more focused on land records and detailed views of these records. GIS and LMIS systems provide tools that support many types of record keeping, analysis and decision-making. He further stated that Land Information System evolved from centuries of map making and compilation of registers. In the early 1960s the potential of electronic computer was recognized in Canada and the united state of America. In the 1970s through 80s, various systems were evolved to replace manual cartographic operations, software systems were developed to process geographic data.

The origin of Land Management Information System lie in two areas: The first is the map oriented work of people such as Land surveyors, Geographers, Cartographers, Geologist, Estate surveyors and Valuers, Town planners and other land related professionals, while the second area is the computer scientist. These two areas form a powerful means of analysis, interpretation and prediction that can be used in many land information application. [7].

II THE STUDY AREA

The study area (Bauchi town) is strategically placed on the junction of the Jos — Bauchi — Gombe and Jos-Bauchi — Maiduguri trunk ‘A’ roads. Figures 1 and 2 shows map of Nigeria and map of Bauchi state respectively. The improvement of Bauchi — Dass road to the South and Bauchi — Ningi road to the North has increased the importance of Bauchi as a distribution centre in addition to its traditional position as an administrative center. Bauchi metropolis is the capital city of Bauchi state. The site is bounded by longitude 09° 48’ E to 09° 50’ E and latitude 10° 18’ N to 10° 20’ N.

Fig. 1: Map of Nigeria showing location of Bauchi State
III. MATERIAL AND METHOD

The data used for this research were obtained from both primary and secondary sources. The Primary sources of data includes the use of questionnaires, interviews and observations while the secondary sources include review of existing literatures, system documentation manuals and the review of existing system source listing.

Interviews and personal observations were carried out for the purpose of finding facts about existing methods and to investigate how the ministry for lands handle land titles and acquisition. In most situations, existing documentation about land cases were reviewed. This helped in fact-finding about the existing system and problems faced. The use of these fact-finding techniques enables the researcher to understand the methods used to derive solutions to land information management problems.

The Structured System Analysis and Design Methodology (SSADM) which is a Software Engineering Methodology that involves system decomposition to sub-system and the systematic analysis of each sub-system were adopted. Flowcharts and Pseudo codes were drawn and written for the proposed solution.

The Expert System methodology, which involved knowledge engineering process of inference and knowledge-based, is also adopted [8].

The software for the implementation of the LMIS was developed using:

1. Java programming language
2. The database was implemented using MySql database
3. Hardware Requirements

Minimum hardware requirement for the system usage are as follows:

Processor : Intel Pentium IV 2.4 GHZ or above
Clock speed : 500 MHZ
System bus : 32 or 64 bits
RAM : 256MB of RAM
Hard disk : 40GB, 60GB

3. Software Requirements

Windows Operating System (OS); The operating system needed for the installation of the software should be windows XP, window Vista and windows 7 and the Language JAVA including MySql database.

IV. RESULTS AND DISCUSSION

The proposed system is an integrity land record Storage and processing system using the Software (LMIS). It comprises of modules for copy of file that will be stored as record, updating the record, and another module for verification of the existing record.

To use the system:

- Switch “ON” the system and wait for it to boot
- Go to the file containing the project i.e. Land Management Information System
- Then the environments will open
- The software will require you to enter the login Username and password followed by clicking the OK button
- The main Screen will be lunch from which you can select the type of record you are going to deal with (Residential, Commercial, Industrial or Conversion of customary title to the statutory right of occupancy) through the menu
To Update The Record:

- Click on the “Edit Menu of the Main Screen”
- In a drop down menu select Edit Record
- Select from drop dawn submenu the type of record to be edited
- The form will opened with “Inputbox“ requesting you to enter the Plots title number to verify the allocation of the plot or not.
- If the plot was allocated to someone, his/her record will be displayed immediately after the message box telling that “The plot was allocated”

To Generate Report

- Click on the File menu of the main Screen
- A drop down menu will be opened
- Select Open to view the report of the allocated plots

The System Input and Output Design

This is the specification of how data are entered into the system. The users of the system are expected to filled in the various information as shown in Fig. 4. This constitutes the input to the system. The input is processed and stored in the database. The input comprises the images (photograph of the owner), Text (Name, date, address, description of the land and its location etc). Fig. 4 below is the design of the interface that will enable the user to enter the desired data for purpose of land acquisition.

![Fig. 4: Input Form for the LMIS](image)

The LMIS Output form

This is a very crucial aspect for the fact that the entire system will be judge by the output produced or received from the system.

A quality output is one, which meets the requirements of the end user and presents the information clearly. Fig. 5 shows the results from the implementation of the LMIS prototype in form of report for plot allocation certificate. This certificate is an evident that the land has been allocated the bearer whose name appear on it.
The proposed system helps the user to interact friendly with the interface as they can easily store, edit, update and retrieve the record. The system requires very low system resources and the system will work in almost all configurations.

It has the following features:

- Ensure data accuracy and reliability
- Minimum time needed for the record storage and retrieval
- Greater efficiency and Better Service
- The user need not depend on records that exist only on cabinet

V. CONCLUSION

The paper presents a software prototype for land administration. It shows the use of ICT for the management of spatially referenced data. The process of converting the existing analogue cadastral data to digital format is the most crucial aspect of creating the land management information system (LMIS), but with the requisite hard and soft ware, that has been achieved.

The result of queries on the database by users is instantaneous, it has reduced the time required to make search on a parcel of land. The land management information system (LMIS) has been developed in such a way that, even non specialist, surveyors, programmers, software engineers, etc would be able to operate the system as the user interfaces are user-friendly.

REFERENCES