International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Application of Digital Cadastre on Tax Assessment for the New Yenagoa City, Tourism Island, Yenagoa, Bayelsa State, Nigeria

Akwaowo Ekpa[1], Aniekan Eyoh[2]

[1, 2, 3] Department of Geoinformatics and Surveying, Faculty of Environmental Studies, University of Uyo, AkwaIbom State, Nigeria

Abstract: ***The management of land and resources has seen many and varied approaches and systems. Land registration and cadastre has been some of the approaches and systems, and a digital cadastre map is the main component of this system. Fundamental to this study was the design and implementation of a digital cadastre to generate digital plans and related attribute information. This also facilitates efficient land management, spatial planning and the issuance of land titles in order to promote security of land tenure, reduce land disputes so as to enhance revenue generation. The study location was the New Yenagoa City, Tourism Island, Bayelsa State, Nigeria. The approach adopted involved acquiring geometric data through ground surveying method, and the non-geometric (attribute) data were acquired through social survey. The database of the layout was designed using the vector data modelling, while the graphical display of the spatial data was performed using AutoCAD 2016 and ArcGIS 10.1. Spatial analysis relevant to cadastre and revenue generation were performed using queries to assess the effectiveness of the system in tax management. The extent of the study area was 221.82 hectares with a perimeter of 7593.699 meters and linear accuracy of 1/54,000.***

Keywords: Digital Cadastre, Land Register, Taxation, Database, Layout**.**

1. Introduction

Land and its resources has been the source of wealth for most societies since the beginning of civilization. However, the management of such land and resources has seen many and varied approaches and systems, such as Land registration and cadaster. Conventionally, cadastre together with registers contain the details of the parcels, such as ownership, type of land use, its value and size, etc, were either used for taxation, which was the original reason for establishing cadastre in many countries, or to ensure security of the property to its owner in some other countries [9].

However, due to the rapid growth of the world's population and economic globalization, the value of land is changing fast and the demand for more varied information items have become increasingly pressing. The data resulting from the traditional, paper-based cadastre are now becoming insufficient. As such, the amount of data involved, accuracy and details required for these maps of localized areas was difficult and often too costly to draft [2].

The importance of a cadastre may be for fiscal purposes (valuation and equitable taxation), legal purposes, to assist in the management of land-use in planning and other administrative purposes. A cadastre can be designed to serve the fiscal and legal requirements, but this study seeks to implement digital cadastre for tax mapping. Tax mapping is a method of identifying real property units, establishing property boundaries, determining actual use and discovering undeclared properties.

Bayelsa State just like others in Nigeria, has experienced cash crunch due to the global fall in oil prices. The aftermath of this effect have impacted negatively on the smooth operations of the government, which were solely depending on the proceeds of crude oil sales. Many individuals and corporate entities before now were evading tax, because there were no efficient records to monitor and evaluate their activities for and revenue generation. A review of the cadastre and land information systems in Bayelsa State revealed that decision makers were not presently deriving sufficient information from the existing systems to make up-to-date decisions. The unavailability of such parcel information system resulted in the following problems: low precision of geometric data; lack of quality and speed to data access; divergence between the map and the register; Lack of supervisory tools; increased land tax defaulters, etc. It was on this background that the Bayelsa State Government inaugurated a development tribunal, that was charged with the responsibility to ensure that the State Government collected appropriate taxes and rates on landed properties and corporate bodies. But the exercise did not yield good results because of lack of efficient records. Hence, an up-to-date and easily accessible cadastre became a primary requirement, which could lead to cadastre reforms in the computerization of both the cadastral maps and registers [4]. It was in-lieu of the above setbacks that this study was conceived to implement a Digital Cadastre for parcel valuation and revenue derivations. Other components included generation of digital plans and related attribute information to enhance efficient spatial planning and issuance of land titles parcel owners, investigate and identify the main type of taxes for the location, promote security of land tenure and minimise land disputes.

Reviews of previous studies revealed the benefits of digital cadaster were indeed enormous. Hence, this study seeks to proffer good options that could help to avert the imminent challenges awaiting the New Yenagoa City Tourism Island.
"Reference [7] observed that cadastre (i.e. cadastral map) together with registers (i.e. land records) containing the details of the parcels, like ownership, type of land use, its value and size, etc. were conventionally used either for

taxation (as was the original reason for establishing cadastre in many countries or to ensure security of the property to its owner in some other countries)." It was added that the traditional/existing cadastre in many developing countries were entirely based on maps and records on paper formats having no cartographic standards with quite outdated information. This restricted their operational efficacy in extracting precise information on land parcels, ownership, and taxation as well as planning development activities.

"Reference [1] stated that data collection was the most expensive part of a spatial information automation project since Spatial Information System was all about the management of spatial and attribute data. The creation of a digital cadastre involved the collection of both spatial and non-spatial data. Primary data acquisition method by land surveying is good for capturing spatial (geometric) data, while attribute data can be obtained through social surveys and personal contact." Land development was a continuous process and every day new parcels of lands were being registered at lands office that was not reflected in the authority records. Because there was no mechanism, many authorities wait until a client submits building plans, and only then do they demand for payments of rates and any outstanding due of the authority for the plan to be approved. So until a client submits a building plan for approval, the authority will tend to lose and cannot meet its budget for that financial year. Another challenge was the lack of appropriate technology. The world has gone digital in its operations and many complex social and scientific tasks could easily be manipulated by computer software depending on the task. Geospatial Information System (GIS) has proved to be beneficial in many fields such as, medicine, engineering etc.

"Reference [6] observed that the value of land was changing fast and the security of land property rights could no longer be guaranteed by the traditional, paper-based, cadastral systems as the data resulting from the classical model of land cadastre had become insufficient." Therefore, lack of skilled manpower led to under-valuation, thus, reducing government's revenue, while over-assessment resulted into disputes which often delay payment of taxes.

2. Study Location

The proposed digital cadastre was intended to be implemented at the New Yenagoa City, Tourism Island, Yenagoa – Bayelsa State, Nigeria. It is bordered by the Onopa Creek on the East, the government house in the South and the West to North by the River Nun. Geographically, it is between Latitudes 040 56' 25.911" N and 040 57' 57.291" N and Longitudes 060 16' 06.099" E and 060 17' 52.711" E.

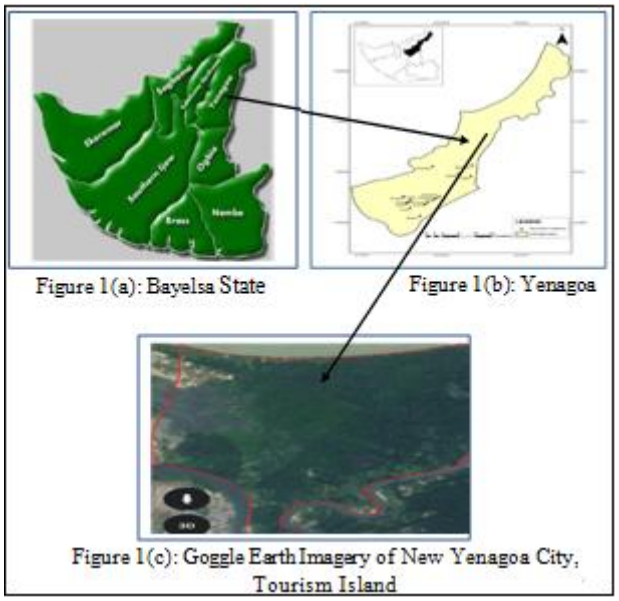

Figure 1: Map of Study Area

3. Methodology

The workflow for the implementation of Digital Cadastre for the tourism island is as shown in figure 2.

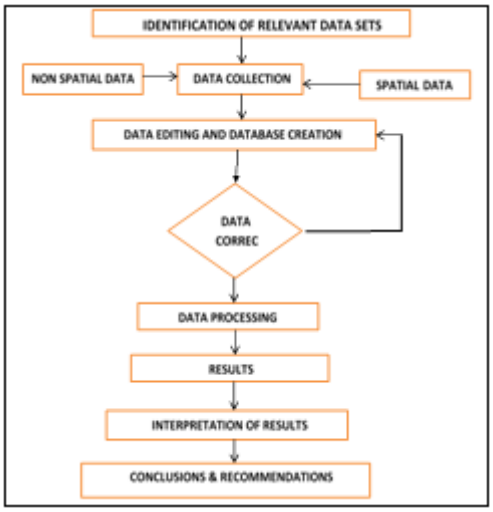

Figure 2: Work Flow of Methodology

The methodology required for implementation of digital cadaster basically involved two phases:
a) Design of Database, and
b) Field Data Acquisition and Processing.

3.1. Design of Database

For the design of the database, the conventional processes based on [5] were adopted, and these included the following.
a) View of Reality
b) Conceptual Design
c) Logical Design
d) Physical Design
Creation of the data base was performed after the geometric data were acquired and processed.

3.2 Field Data Acquisition and Processing

3.2.1Reconnaissance

The reconnaissance process included gathering all existing survey data about the project area, searching for controls around study area, equipment selection, estimating cost of execution, and to decide on the approach of execution. To this end, selected controls data required for the study was obtained, and these are as shown in Table 1 and 2.

Table 1: Coordinates of Controls Set 1.

Control Id	Eastings (M)	Northings (M)	Location Description
PBB 5190	428309.929	106413.809	Along River Nun
PBB 5191	428462.792	106604.444	Along River Nun
PBB 5192	428606.098	106806.647	Along River Nun

Table 2: Coordinates Controls Set 2.

Control Id	Eastings (M)	Northings (M)	Location Description
PBB 5221	428470.434	104813.430	Along Ushen Creek
PBB 5222	428361.584	104749.366	Along Ushen Creek
PBB 5223	428324.518	104662.460	Along Ushen Creek

3.2.2 Equipment Selection/Software

Survey equipment used for the geometric data acquisition was Leica Flexline Total Station instrument (TS 09) and its accessories. The software used included AutoCAD and ArcGIS 10.1 for spatial data management and analysis. Test of the equipment was done to ascertain their working condition.

3.2.3 Geometric Data Acquisition and Processing

Prior to field data acquisition, validation tests on the control stations were performed, and the results revealed that they were in-situ. The geodetic parameters for the established controls were:

- Coordinate System: Nigeria West Belt
- Projection: Transverse Mercator
- Datum: Minna
- False Easting: 230,738.2600
- False Northing: 0.0000
- Central Meridian: 4.5000
- Scale Factor: 0.9998
- Latitude of Origin: 4.0000
- Units: Meter

The processes involved in the data acquisition were:
1) Boundary Lines Opening and Pillars emplacement.
2) Traversing of boundary pillar positions.
3) Processing of the data, and
4) Plan drafting.

3.2.4 Design of the Layout Plan

On completion of the perimeter survey, the survey plan was produced, to enable the design of the layout. This exercise was performed by a team of professionals in the Ministry of Lands and Survey in collaboration with Physical Planning, Research and Statistics Department, Bayelsa State Physical Planning and Development Board. The layout design plan was later used to set-out the individual plots. Thus, the conventional ground survey method was employed using Leica Flexline Total Station instrument (TS 09).

3.2.5 Non Geometric Data Acquisition

The non-geometric (attribute) data were mostly acquired through records, social survey, such as oral interviews and questionnaires. However, for the purpose of this study, names of parcel owners and other information regarding ownership of parcels were assumed.

3.3 Creation of the Database

The stages adopted during the database creation involved the following;
1) Physical database creation, i.e. to input data into the database,
2) Query of the database to test its efficiency and effectiveness in order to meet the user requirement, and
3) The graphical display of the spatial data content of the database.

In the process of creating the database, the management of the database system was then required. Thus, the development of the logical function for the creation and management of access to the database was attained through Database Management System. This incorporated a set of programs which were used in manipulating and maintaining the data and information in database. The database created was dynamic enough to welcome new dataset in form of updating it to make it useful even in the future. It was also capable of supporting environmental monitoring, developmental planning, etc.

Also, some security measures were put in place to restrict unauthorized personnel access into the data or database. Therefore, password was created and back-up of the data with flash drives and CD-ROMs were made.

4. Results Analyses and Discussion

4.1 Results Analyses

The result of the traverse showed the area of the study was 2,218,175.274 Square meters (221.9 hectares) with a perimeter of 7593.699 meters. The total number of plots (residential and commercial) set out was 850 plots. The linear accuracy of the survey processes attained stood at 1/54,000.

4.2 Spatial Analyses

This deals with the locations of features in relation to other features or the study of the locations and shapes of geographic features and the relationship between them. Most GISs are equipped with a set of basic analytical functions that enable data to be manipulated, analyzed and queried. These functions coupled with appropriate databases, provide GISs with their powerful capabilities for supplying information that could enhance planning, management, and decision making. They enable data to be stored, retrieved, viewed and analyzed spatially.
A query often appears in the form of a statement or logical expression. In this study, ArcGIS 10.1 was used and the query contains a field, an operator, and a value. This was

made possible as a result of the link between the attribute and the geometric data. The queries performed were the single criterion and multiple criteria modes. These were presented with their syntaxes as shown in the figures below.

4.2.1 Single Criterion Query

Queries in this category were based on single condition. In other words, results gotten from this query satisfied only a particular requirement. This query and its syntax are shown in figure 3 for all the parcels that were used for commercial purposes.

Figure 3: Query to show Parcels used for Commercial *(Highlighted in Yellow Colour)*

4.2.2Multiple Criteria Query

This in contrast to the single criterion analysis analyzed or satisfied more than one condition. The analyses performed under this and their syntaxes were as shown in figure 4. It showed the owners who were from Nembe Local Government, and their property Area was less than or equal to 1500 Square Meters.

Figure 4: Query showing Parcel owned by Nembe Indigenes and Area <= 1500 Square Meters (in Yellow Colour)

Other query performed was the "Select by Location" which enabled parcels to be selected based on their relative location to other features around them. For instance, if one wants to know all plots around a public facility, one could select such plots by carrying out a Select by Location query. This tool was used to select parcels that were 500m radius close to s school as shown in figure 5.

Figure 5: Plots within 500m Radius to a School *(Highlighted in Yellow Colour)*

4.3 Discussion

The Bayelsa State Government through the Board of Internal Revenue are saddled with responsibility to generate taxes. For the purpose of this study, discussion will only focus on tax generated through stamp duty. Stamp duty, in this context, refers to tax levied on financial transactions and on documents. In Bayelsa State, the tax rate for stamp duty stands at three (3%) percent of the value of a property. Apart from the public parcels which were exempted from payment of tax, there were 834 residential plots and 16 commercial plots. Consider the facts that the value of each residential plots were fixed at ₦3,000,000 Naira (US $8,200 Dollars), and the commercial plots were ₦4,500,000 Naira. ($12,300 US Dollars). It therefore implied that 3% stamp duty for each residential plot was ₦90,000 Naira ($247 Dollars) per annum, while the commercial plots was ₦135,000 Naira ($370 US Dollars) per annum. Going by the above figures, the government would have generated the sum of ₦75,060,000 ($205,643 US Dollars) for the residential plots and ₦2,160,000 ($6,000 US Dollars) if all plot occupiers were obliged to fulfill their civil rights by payment of tax due to them.

Translating the above discussion into this scenario; a hypothetical distribution of tax defaulters was shown in figure 6. The number would call for serious concerns in real life situation, if government cannot track these owners to recover the accrued taxes.

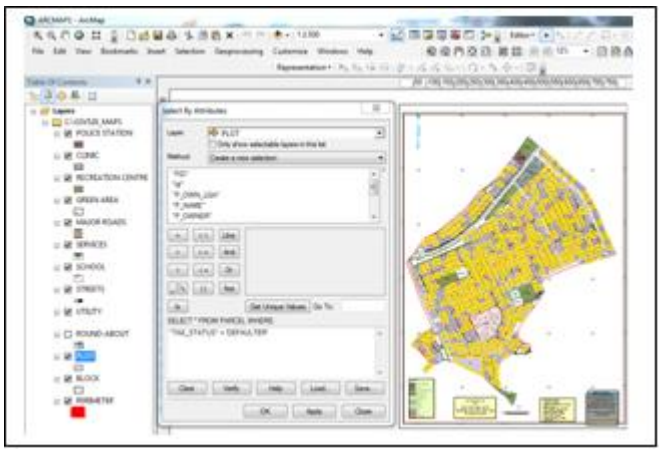

Figure 6: Distribution of Tax Defaulters *(in Yellow Colour)*

Taking a critical look into the above scenario, the significant

role of implementing a Digital Cadastre in Bayelsa State can go miles in enhancing government planning, decision making, management of resources, as well as effective means to generate internal revenue. Spatial analysis performed has produced invaluable results that are very helpful in understanding the Layout. To this end, the benefits of this system include, but not limited to the followings:

1) Security and certainty of ownership: Accurate compilation of land records enhances formal identification and recognition of the ownership of the land and other rights that exist in the land thereby leading to social cohesion. Hence, the value of land was changing fast and the security of land property rights was no longer guaranteed by the traditional, paper-based, cadastral systems as the data resulting from the classical model of land cadastre had become insufficient [6].
2) Improved conveyancing: The cost and delay in transferring property rights can substantially be reduced through the operation of a computerized digital cadastre. Duplication of titles to land can be avoided.
3) Monitoring of land market: The digital cadastre could be used to monitor and if necessary to control land transactions and ownership.
4) Management of state land: the development of digital cadastre and the subsequent creation of cadastral maps in a systematic manner would benefit the State greatly in the administration of her lands, leading to improved revenue collection from the lands.
5) Improvement in physical planning: a digital cadastre can be used to support physical planning in both the rural and urban areas

Matching the benefits/applications with what has been carried out in this project, it was clear that digital cadastre provided a platform for the detailed investigation of the related issues in connection with study area. Thus, "Reference [8] confirmed that the development in information technology has made the automation of spatial and non- spatial database possible, and the automated databases have proven to be cost-effective, and more efficient, compared with manual registration systems." That the associated attribute data also proved to be very much helpful in the analyses and implementation of different sustainable developmental plans.

5. Conclusion

The concept of digital cadastre and the need for the adoption of Geographic Information Systems technology for revenue collection and effective land management was examined. The initial high cost of developing a digital cadaster may be costly, but the long-term benefits completely out-weigh the initial cost and challenges. As earlier stated, monitoring land use and allocation, property development and taxation were continuous exercises, and the returns are also continuous. Provision and monitoring the effectiveness and distribution of social amenities with the increase in population became very easy. This assertion was also upheld by [3]. It was noted that the analogue maps and plans had long been used as database but lacked some modern requirements and that the digital cadastre was the best alternative to meeting up these requirements. He went further to state that modern spatial information systems, based on electronic data processing provided many cartographic products within their broad spectrum of products. Therefore, with the computer hardware becoming readily available and affordable, with many sophisticated GIS software on the increase by the day, the task before policy makers was to create an enabling environment geared towards a digital cadaster.

Finally, the aim of this project was achieved as the database was tested and found suitable in assisting to improve the Internally Generated Revenue (IGR) and the management and maintenance of the parcels and utilities in the New Yenagoa City, Tourism Island in Bayelsa State, Nigeria.

References

[1] G. H. Ayeni, "Land Registration reforms in Nigeria – Past, Present and Future, The Surveyors Perspective," Technical Paper at Nigeria Institution of Surveyors Annual General Meeting and Conference Kano, Nigeria, 2006.
[2] E.Y. Dale & M. G. McLaughlin, "Land Administration and Cadastral Trends: The Impact of the changing humankind-land relationship and major global drivers," In Proceedings of the UN-FIG Conference on Land Tenure and Cadastral Infrastructures for Sustainable Development, Melbourne, Australia, 2007.
[3] S. R. Demers, "Resource Management: The Land Administration and Cadastral Systems Components," Journal of Surveying and Mapping, Vo149, No2 Washington, D.C Duxbury Press, 2007.
[4] R. R. Henssen, "Data Flows, Standards and Incremental Cadastral update" Proceedings of 8th Colloquium of the Spatial Information Research Centre, University of Otago, New Zealand, 2016.
[5] M. K. Kufoniyi, "Cadastral Database, An Essential Component of the Fundamental Datasets of a National Geospatial Data Infrastructure," A paper Presented at Annual Conference of Nigerian Institution of Surveyor, Owerri, Nigeria, 2002.
[6] A. A. Lemmen, "Intellectual property - surveyors' new property," In Proceedings of First Trans-Tasman Surveyors Conference, Newcastle, NSW, 2013.
[7] D. H. Nasir, "Survey questions: handcrafting the standardizes," Questionnaire, Beverley Hill, 2010.
[8] O. O. Odedare & J. M. Christos, "Evolving Technical Cadastre as Urban Vacant Land Management Tool," A paper presented at the Staff Workshop Seminar Series of the Federal School of Surveying, Oyo, Nigeria, 2011.
[9] A. F. Pearce & Q. U. Ale, "A paradigm shift - surveying in a digital environment," In Proceedings of 37th Australian Surveyors Congress, Perth, Australia 2013.