Toward the Development of Geographic Names Information Systems for the Management of Telecommunication in Nigeria

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Key words: Geographic, Names, Information, Systems, Telecommunication

SUMMARY

Global competition is forcing telecommunication companies to stretch their boundaries as never before and this is requiring, efficiency and innovation in every aspect of their enterprise if they are to survive. With these kinds of challenges, telecommunication firms worldwide are turning to *Geographic Names information Systems (GNIS).*

With increasing performance capabilities more and more Telecommunication providers are establishing and honing a competitive edge by integrating their workflow based on the location of their assets, customers, sales territories and coverage areas. This set the stage for healthy competition between Telecommunication Companies and the increasing popularity of mobile Communication devices, aggressive growth strategies, and the continuing rise of internal competition into a national rivalry. Locating potential customers and deciding which service to provide them involves data about the town's delineations, cities and villages in the countries into urban, semi urban and rural areas. For example, this helps to identify possible locations for base stations according to where traffic is, and where it is likely to be.

In Nigeria, there are over 37,092 place names covering the whole Country from populated places such as cities, towns and villages up to non-pullulated places such as settlements. Using Geographic Names technology for the management of the telecommunication industry enables telecommunication professionals to integrate location-based data into analysis and management processes in network planning and operations, marketing and sales, customer care, data management, and many other planning and problem-solving tasks. A GIS can integrate location-based data from databases all over the world to help users resolve and streamline everyday business issues.

Therefore, this paper will discuss the approach, Methodology and Modeling Techniques adopted for the development of Geographic Names Information Systems.

TS 46 – Place Names and Addresses 1/11
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of Telecommunication in Nigeria

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005

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1. WHY GEOGRAPHIC NAMES INFORMATION SYSTEMS IN TELECOMMUNICATION INDUSTRY

The telecommunications industry is changing rapidly, resulting in tough competition and an ever-increasing scope of services offered to customers. Solving the following business problems of telecommunication industry requires a good understanding of where your customers and facilities exist and good information about those locations. Therefore, in the bid to have a proper delineation of geographical areas/zones for licensing purposes, the Commission request competent organizations to tender for a study to delineate the towns, Cities and Villages in the Country into Urban, Semi- Urban and Rural Areas. Locating potential customers and deciding which service to provide them involves date about the town's delineations, cities and villages in the countries into urban, semi urban and Rural Areas. For example, this helps to identify possible locations for base stations according to where traffic is, and where it is likely to be.

2. GOALS AND OBJECTIVES OF GEOGRAPHIC NAMES INFORMATION SYSTEMS IN TELECOMMUNICATION INDUSTRY

2.1 Goal 1 Achieve National Focus for Telecommunication Information Initiatives

2.1.1 Strategies

- Align Geographic Names Information System initiatives to telecommunication, economic, social and environmental priorities of all levels of government, industry and the general community
- Increase high-level political awareness and support
- Establish effective communication with users of telecommunication information

2.2 Goal 2 Create Strategic Organisational Framework

2.2.1 Strategies

- Build effective organisational structures for communication and development of GNIS initiatives
- Establish effective relationships with key stakeholders
- Build and maintain international relationships as a basis for placing GNIS
- initiatives into a broader context and maintaining a strategic oversight on initiatives in other countries

2.3 Goal 3 Promote Geographic Names Information Systems for Nigeria Telecommunication Industry

2.3.1 Strategies

- Promote a clear understanding of the GNIS and develop a practical implementation plan that is actively supported by key stakeholders.
- Clearly identify the direct linkages between the GNIS and the issues and objectives that are priorities for government and key stakeholders.

2.4 Goal 4 Encourage the Use of Spatial Information to Support Better Decision Making in Telecommunication Industry

2.4.1 Strategies

- Provide a framework for development of policies and standards, which facilitates access to telecommunication information
- Encourage the development of skills needed to manage and use spatial information
- Develop a better understanding of the role of spatial information in improving decision-making in Telecommunication Industry

3. APPROACH, METHODOLOGY AND MODELLING TECHNIQUES ADOPTED FOR THE DEVELOPMENT OF GEOGRAPHIC NAMES INFORMATION SYSTEMS

The main components of the approach, methodology and modelling techniques adopted include and not limited to the following:

- Desk Studies and Literature Review (include review of existing data and previous study completed)
- Review of Best Practice in Development
- Field Survey
- GIS Management

3.1 Desk Study and Literature Review

Over years, various government institutions, non-governmental organizations, research institutions, industry and business, and other stakeholders have conducted studies, data collection and research regarding the study. During development stage of the project we conducted a comprehensive research for relevant information regarding the delineation of town and cities in the country into urban, semi-urban and rural areas from the Federal Government of Nigeria to the State Government, as applicable and also make reference to the relevant documents as published by Federal Survey Department, National Population Commission and any other relevant organizations.

TS 46 – Place Names and Addresses
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of Telecommunication in Nigeria

3/11

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005

3.2 Review of Best Practice in Development.

The research for relevant information regarding the study is intended to:

Allow an opinion of international and national best practice in the delineation and development of gazetteer of place name provide information regarding delineation of Towns, and cities in the country into Urban, semi-urban and Rural Areas.

3.3 Field Survey

3.3.1 Data Acquisition Using GPS

For the physical definition of locations to which data is applicable, the GPS Readings were taken. Position determination by GPS were carried out using Handheld GPS. The handheld GPS was configured before use so as to ensure that data are capture correctly by the Field Enumerators and the GPS setting for the data collection was as follows:

– Geodetic datum – (Minna Datum)
– Geo-referencing Coordinates – (Decimal degrees to five decimal place)
– Units – (Metric Unit)
– Position Accuracy - 1-5 meters (3-17ft) with DGPS correction, 15 meters (49ft) with handheld GPS.
– Acquisition Time for each GPS readings – 10-15 minutes.
– For consistency and accuracy of figures, readings were taken in degree, minute and second which the database program automatically converted to a five decimal place degree number and stored in a datafield in the database.

3.3.2 Storing of the Data Collected on Database

The data collected were stored on a database, which also contain records on almost all the millions geographic names in Nigeria - from populated cities, villages, and settlements. Entries included information such as the federally recognized name for the feature; geographic names; the county or counties in which each named feature was located; the geographic coordinates (in degrees, minutes, and seconds, as well as decimal degrees) that locate the approximate center of an area. The Place Name Database therefore, contain the following information about a selected geographic feature:

– Federally recognized feature name,
– Feature type,
– Eevation (where available),
– Estimated 1991 population and population projection for 2003 of incorporated
– cities and towns,
– State(s) and town(s) in which the feature is located,

–   Latitude and longitude of the feature location,

3.4 GIS Management

GIS technology enables telecommunication professionals to integrate location-based data into analysis and management processes in network planning and operations, marketing and sales, customer care, data management, and many other planning and problem-solving tasks. The thirty six States and FCT analogue maps covering the entire 774 Local Government Areas of Nigeria were acquired and converted into digital formats and stored in industry standard topological formats e.g., Arcview shape files as *shp, apr, dbf, shx, sbn and sbx* files.

The thirty six States and FCT digital maps in ArcView files have a comprehensive metadata comprising of the following:

–   Map of the Each State showing the State Boundary
–   Map of the Each State showing the Local Government Boundary
–   Map of the Six Geopolitical Zones
–   Map of the State showing the Urban, Semi-Urban and Rural Areas

4.   IMPORTANCE OF THE GEOGRAPHIC NAMES INFORMATION SYSTEMS (GNIS) IN TELECOMMUNICATION INDUSTRY

4.1 GNIS as NCC Official Repository

For the purpose of licensing the *Geographic Names Information Systems (GNIS)* is being used as the official instrument for geographic names of cities, towns, villages and settlements by National Communication Commission (NCC). The GNIS is also being used as repository of geographic names for telecommunication operators to which names enquiries, names issues and new names proposal can be directed. The GNIS is supporting the telecommunication industry as the source for the gazetteer search in the National Communication Commission GNIS Map viewer for Federal Boundaries and geographic features not available from state or local government areas.

Information in the *Geographic Names Information Systems (GNIS)* can be retrieved, manipulated, arranged, and analyzed to meet the needs of a wide variety of users. This is because the GNIS is designed to:

–   Assist in establishing uniform geographic name usage throughout the Federation.
–   Provide an index of names found on Federal, State, and other maps.
–   Eliminate duplication in time and money spent by Government agencies, industry, and institutions to organize similar data files for specific needs.
–   Provide an interface for integrating data from other systems for multidisciplinary use.
–   Provide standardization of data elements and their coded representation for the telecommunication industry.

TS 46 – Place Names and Addresses   5/11
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of
Telecommunication in Nigeria

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005

- Provide support for the Nation's infrastructure.
- Meet National Communication Commission information requirements prescribed by law.

4.2 Develop criteria for the delineation of Cities and Towns into Urban, Semi- Urban and Rural Areas

4.2.1 Population

The population figures for the each states, local government area and settlements are fundamental as they provide some indication of delineation criteria. The 1991 population census for the states, local government area and settlements were obtained from the National Population Commission and projected to 2004. The delineation criteria used were based on projected data of 2004 as follows:

4.2.2 Urban Centers

- Urban (U) = State Capital + Population > 50,000
- Semi-Urban (SU) = Population > 25,000
- Rural (R) = Local Government Headquarters + Population < 25,000

A further classification to reflect settlements that are not covered by the above definition will be specified as:
- Settlements (S) = Population < 10,000.

4.3 Categorize the Cities and Towns into Urban, Semi-Urban and Rural Areas

4.3.1 Urban and Rural Classification

The National Population Commission classifies as "urban" all territory, population, and housing units located within an urbanized area (UA) or an urban cluster (UC). It delineates UA and UC boundaries to encompass densely human settlements. The National Population Commission classification of "rural" consists of all territory, population, and housing units located outside of UAs and UCs. The rural component contains both place and non-place territory. Geographic entities, such as census tracts, counties, metropolitan areas, and the territory outside metropolitan areas, often are "split" between urban and rural territory, and the population and housing units they contain often are partly classified as urban and partly classified as rural. Therefore, the criteria and the hierarchy for categorize the cities and towns into urban, semi-urban and rural areas will include and not limited to the following;
- Communities or major settlements
- Sub centers, which may be larger communities, trade or traffic centers, or other faster developing local points.
- Local Government Area Centers (Headquarter)
- Centers such As State Capitals

– Major Cities or Sub centers that are developing in the vicinity of cities

These classification criteria are general indications and can vary from state/geo-political zone. However, this system for classification shall be applied as far as possible. This classification is essential in order to allow the spatial co-ordination of various environmental and social economic, as well as technical and physical aspects of development. The aim is a spatial arrangement of services, facilities, functions and land uses that achieves a good balance between the different spatial demands and makes the best possible use of the resources and land. Further analysis out of the criteria will be carried out to establish conditions of the state/geo-political zones relating to:

– Structure and spatial Organisation of the state/Geo-political zone
– Role and function of towns / settlements
– Business, Industrial and Market development
– Catchment areas
– Natural settings/ecological zones
– Settlement patterns
– Social facility such as Education, Health and water
– Rural-urban relationships
– Urban poverty Areas
– Land use pattern
– Major facilities
– Potentials and constraints

4.4 Production of the List of Cities, Towns, Villages and Settlements in Nigeria.

A definitive gazetteer for place names covering the over 37,092 places in Nigeria has been complied. This contains information about physical and cultural geographic features both physical and cultural geographic features both current and historical. The gazetteer is tagged *Geographic Names Information Systems (GNIS)*. The Names of the over 37,092 towns and cities alongside their National Grid reference making this the most comprehensive place name index covering the whole of Nigeria is listed alphabetically as they appear on all the maps.

5. PROBLEMS ENCOUNTERED

5.1 Lack of Up-To-Date Maps

Federal and State Governments maps are out-date

TS 46 – Place Names and Addresses   7/11
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of
Telecommunication in Nigeria

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005

5.2 Information not Readily Available

Information framework, which will give the community access to the Fundamental Datasets, is still posing significant problems.

5.3 Duplication of Data by Various Agencies

There is lack of cohesive framework for effective coordination of geo-spatial activities, which is resulting in unnecessary duplication of efforts and outputs.

5.4 Discrepancies in Population Data

Population data by various agencies and ministries differ.

5.5 Technical Standards

In the context of Geographic Names Information Systems, Technical Standards need to be defined. This is because national Geographic Names Information Systems requires standards in each of the following areas: reference systems, data models, data dictionaries, data quality, data transfer, and metadata.

5.6 Lack of Importance of GIS by Decision Makers

This is a serious limitation, largely as a consequence of the apparent lack of awareness on the part of decision-makers about the value and benefits of GNIS.

6. RECOMMENDATIONS

Considering these limitations, it is therefore, essential that National Communication Commission should be put in place a guide to update the GNIS regularly and this should include:
– providing a co-ordination mechanism for the update and maintenance programs of the geographic names database.
– defining and supporting a national directory (system) for the fundamental geographic datasets
– facilitating the development and implementation of technical standards on geographic names datasets
– sponsoring multi-agency GIS demonstration and pilot projects
– identifying education and training needs and facilitating the implementation of training programs
– assisting each sphere of government to define and co-ordinate their respective areas of responsibility for fundamental names datasets, and to co-ordinate cross-jurisdiction policies, standards and programs.

7. CONCLUSIONS

Geographic Names Information System (GNIS) is the key to planning and sustainable management and development of utilities services at Federal, State and Local levels. It is also fundamental to the development of the economic and social infrastructure, provision of community services, effective government administration and resolution of community conflicts. The GNIS is necessary to support Nigeria's economic, political and social development and well-being. Not only is it essential for the development of an innovative and competitive spatial data industry, it is an indispensable resource for decision-making across all sectors of business, industry and the community.

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TS 46 – Place Names and Addresses
9/11
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of Telecommunication in Nigeria

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005

BIBLIOGRAPHICAL NOTES

Anthony Abiodun Adeoye was born on October 1st 1960 in Lagos. He studied at the University of East London and University of Westminster, London where he obtained BSc and MSc in Surveying and Information Systems Design respectively. He is an Associate of the Royal Institution of Chartered Surveyors, United Kingdom, a member of Nigerian Institution of Surveyors, a member of British Society of Computer (GIS Specialist Group), a member of Computer Association of Nigeria and a member of Nigerian Institute of Management.

In 1992, he qualified as a Chartered Surveyor, while in England; he worked with Surrey County Council and London Borough of Barnet from 1988 – 1993. During this period, he gained in-depth knowledge of Information System Design, Software Engineering, ranging from the Information Technology Strategy through to implementing Computer Aided Software Engineering (CASE).

In 1993, on his return to Nigeria, he started the awareness campaign of the importance of computers for the Surveying Industry. He distinguished himself in professional life, he has achieved a first in some notable areas of development in the country's system by the originality of his ideas. These include:

- Authorship of the only/first Textbook titled *"Computerised Information Systems for Surveyors"* – the first and only book on the subject.
- Authorship of the only/first indigenous Textbook titled *"Geographic/Land Information System – Principle and Applications* – the first and only book on the subject.
- Authorship of the only/first indigenous Textbook titled *"Geographic Information System – Operations and Management* – the first and only book on the subject.
- Over 70 articles in learned journals within and outside the country.

Awards

Federal Government
Merit Award by the Federal Government of Nigeria in appreciation of my contribution as a Resource Person at the workshop of establishing a Geographic/Land Systems (GIS/LIS) in Nigeria 1994.

NIS National
Nigerian Institution of Surveyors Certificate of Appreciation for my contribution to professional advancement during the year 1994.

NIESV Ogun State Branch
Award of Excellence by the Nigerian Institution of Estate Surveyors and Valuers (Ogun State Branch) in recognition of my role as a Guest Lecturer at the Annual Seminar held at Abeokuta 1996.

TS 46 – Place Names and Addresses   10/11
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of Telecommunication in Nigeria

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005

NIS Lagos State Branch
The Most Active Surveyor of the Year - Nigerian Institution of Surveyors Lagos State Branch 1997.

World Federation of Surveyors (FIG)
The First African to Present a paper at the Commission 3 - Land Information Systems of the World Congress of Surveyors held at Brighton, United Kingdom 1998.

ACEN
Award of Excellence by the Association of Consulting Engineers of Nigeria in recognition of my role as a Guest Lecturer at the Annual General Conference held at Ikeja, Lagos 1999.

Anthony Adeoye is the Managing Director of AAC Consulting & Co., a firm of Chartered Surveyors with areas of specialisation in Geographic Information Systems.

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TS 46 – Place Names and Addresses   11/11
Anthony A. Adeoye
TS46.4 Toward the Development of Geographic Names Information Systems for the Management of Telecommunication in Nigeria

From Pharaohs to Geoinformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt April 16-21, 2005