

# **National Geographic Information Structure for Sustainable Development in Nigeria**

**Anthony A. ADEOYE and Babatunde A. OKUNLADE, Nigeria**

## **ABSTRACT**

The terminology adopted for the Nigerian Spatial Infrastructure is National Geographic Information Infrastructure (NGII). The National Geographic Information Systems (NAGIS) concept is widely accepted by the Nigerian geospatial community. The National Planning Commission has commenced the process of establishing, for Nigeria, National Geographic Information System (NAGIS). The plan, which also includes the establishment of an associated commercial website known as “New Nigeria Web site”. The NAGIS project is in two phases: Phase one is the project documentation, while phase two is the full-fledged project implementation. Phase one has been completed and significant progress has been made towards the achievement of phase two. NAGIS is one of the steps towards the realisation of National Geographic Information Infrastructure (NGII) in order to create a stronger, broader, safer and more sophisticated National Topographic Database.

The purpose of NAGIS and NGII is to make accurate and timely spatial data readily available to support sound decisions and do so with minimum duplication. The NAGIS and NGII are to promote and improve data sharing as well as measures which ensure that spatial data collected are readily available and useable among potential users of geographic/land information systems such as federal, state and local governments, citizens, private sector organisations, and academia. The NAGIS and NGII are to be used as valuable and powerful decision support system for effective national planning, efficient resource allocation and sustainable development planning. This paper will describe the steps taken towards the development of NGII in Nigeria and also outline problems encountered and describe the action plans towards the solving of the identified problems.

## **CONTACT**

Anthony A. Adeoye, BSc, MSc, ARICS, MNIS, AMNIM, Managing Director and  
Babatunde A. Okunlade, BSc, ANIS, Manager – GIS Application Development  
Anthony Adeoye & Co.  
Olatunji House,  
299, Ikorodu Road,  
Idi-Iroko Bus Stop, MaryLand  
Lagos  
NIGERIA  
Tel. + 234 1 497 4220  
Fax + 234 1 496 2629  
E-mail: aacogis@yahoo.com

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## 1. INTRODUCTION

The terminology adopted for the Nigerian Spatial Infrastructure is National Geographic Information Infrastructure (NGII). The National Geographic Information Systems (NAGIS) concept is widely accepted by the Nigerian geospatial community. The National Planning Commission has commenced the process of establishing, for Nigeria, National Geographic Information System (NAGIS). The plan, which also includes the establishment of an associated commercial website known as “New Nigeria Web site”. The NAGIS project is in two phases: Phase one is the project documentation, while phase two is the full-fledged project implementation. Phase one has been completed and significant progress has been made towards the achievement of phase two. NAGIS is one of the steps towards the realisation of National Geographic Information Infrastructure (NGII) in order to create a stronger, broader, safer and more sophisticated National Topographic Database.

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## 2. NATIONAL SPATIAL DATA INFRASTRUCTURE (NSDI)

National Spatial Data Infrastructure is defined, as information infrastructure needed to support the collection, maintenance and utilisation of land and geographic information in a particular country. The information infrastructure encompasses technology, policies, human resources, standards, institutional arrangements and funding necessary to promote sharing of land and geographic data throughout all levels of government, the public and private sectors, and the academic community. Governments throughout the world are beginning to recognise that information is one of the most critical elements underpinning decision making for economic, social and political development, and the need to assign resources to the establishment of an effective Spatial Data Infrastructure (SDI). Different countries adopt different names for their NSDI, for example:

- America adopted National Spatial Data Infrastructure (NSDI)
- Britain adopted National Geospatial Data Framework (NGDF)

- Malaysia adopted National Spatial Data Infrastructure (NSDI)
- Australia adopted Australia Spatial Data Infrastructure (ASDI)
- Russian Republic adopted National Spatial Data Infrastructure (NSDI)
- Ghana adopted National Framework for Geo-spatial Information Management (NAFGIM)
- South Africa adopted National Spatial Information Framework (NSIF)
- Nigeria adopted National Geographic Information Infrastructure (NGII)

### **3. OVERVIEW OF NATIONAL GEOGRAPHIC INFORMATION INFRASTRUCTURE (NGII) IN NIGERIA**

Many activities of the Federal Government of Nigeria and the community depend on accurate and current information relating to land and geographic information. It has become increasingly obvious that in order to achieve a widening range of objectives, land and geographic information must be readily available to different spheres of Government for analysis and integration. Therefore, the Federal Government of Nigeria embraced the need for creation of spatial data infrastructure so as to support the collection, maintenance and utilisation of geographic information systems for effective operation and management of spatial data. The NGII is to be a valuable tool and powerful decision support system for:

- Effective National Planning
- Efficient Resource Allocation and Control
- Sustainable Development Planning

#### **3.1 Capabilities of the NGII**

##### 3.1.1 Capacity Building

The NGII will be a major contribution toward capacity building in Nigeria. Apart from the planning functions which the NGII will serve, an associated commercial Web site know as “New Nigeria Web Site” will be established from very high integrity data that will be generated during the project execution. NGII and the New Web Site will be of immense value to Nigerian Government, International Finance Organisations, Development Agencies, Potential Investors, Non-Governmental Organisations, and Foreign Governments etc.

##### 3.1.2 Investors

The Foreign Investors will be able to use the NGII to perform the following:

- Monitor the investment promotion activities in the country;
- Initiate and support measures, which shall enhance the investment climate in Nigeria for both Nigerian and Non-Nigerian Investors;
- Promote investment in and outside Nigeria through effective promotional means;
- Collect, collate, analyse and disseminate information about investment opportunities and sources of investment capital, and advises on request, the availability, choice, and suitability of partner in joint venture projects;
- Assist incoming and existing investors by providing support services;

### 3.1.3 International Community

In addition to the uses and capabilities stated, NGII is also expected to have the following capabilities and usefulness by:

- Enabling the International community to see the wealth and worth of the nation, including indirect assets, and the various liabilities and encumbrances on the national wealth.
- Allowing the international community in evaluating the success or impact of Government policies.
- Monitoring, valuing & using resources.
- Capturing patterns, assess progress of particular developmental programmes or projects
- Measuring the impact of specific policies on the population.

### 3.1.4 Decision Making and National Planning

All organisations need information in order to survive. Most have a large number of data sources but are hampered by their inability to combine them in a meaningful way. The rules of business in the public and private sectors have been changing and are continuing to change rapidly; greater emphasis is now being placed on management's capability to perform against ever tightening criteria both internally, and in response to the demands of regulatory bodies. Therefore, the NGII will be used as management support tools that will provide information to aid decision making.

## **4. NIGERIA'S STRATEGY FOR THE NGII**

The NGII has come to be seen as the technology, policies, criteria, standards and people which are necessary to promote geospatial data sharing throughout all levels of government, the private and public sectors, and academia. It is a set of actions and new ways of accessing, sharing and using geospatial data that enables far more comprehensive analysis of data to help decision-makers chose the best course(s) of action.

### **4.1 Vision of Nigeria for the NGII**

The vision of this infrastructure is to reduce duplication of effort among agencies, improve quality and reduce costs related to geographic information, to make geographic data more accessible to the public, to increase the benefits of using available data, and to increase data availability.

### **4.2 Mission of Nigeria for the NGII**

Our mission is to provide for efficient and effective management of and use of land and geographic resources to support economic growth, poverty eradication and sustainable development.

### **4.3 Goals and Objectives of Nigeria for the NGII**

#### Goal 1 Achieve National Focus for Spatial Information Initiatives

##### Strategies

- 1.1 Align National Geographic Information Infrastructure initiatives to economic, social and environmental priorities of all levels of government, industry and the general community
- 1.2 Increase high-level political awareness and support for the NGII
- 1.3 Establish effective communication with users of spatial information

#### Goal 2 Create Strategic Organisational Framework

##### Strategies

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

#### Goal 3 Promote Spatial Data Infrastructures for Nigeria

##### Strategies

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

#### Goal 4 Encourage the Use of Spatial Information to Support Better Decision Making

##### Strategies

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

### **4.4 NGII Workplan**

Consequently, the steps adopted to implement NGII are described below:

- Definition of a programme of work, which will enable the goals and objectives to be fulfilled;
- Implementation of the work programme;
- Managing the work programme and setting targets, defining required deliverables,

- monitoring and control;
- Generating enthusiasm and widespread support;
- Identifying issues and problems, and taking action to resolve them;
- Putting people in touch with the right experts to solve problems together;
- Developing solutions, which are acceptable to the whole community ranging from information users to systems and solutions suppliers to data providers;
- Regular review and revision of the NGII work programme;
- Establishment of Metadata service;
- Establishment of NGII and NAGIS Web Sites for sharing and dissemination of information;
- Commercialisation of NGII and NAGIS;
- Drawing up of NGII Research Agenda;
- Widespread awareness of, and support for, NGII; and
- Appraisal of NGII Project reports and results through seminars and workshops.

## **5. NGII ACHIEVEMENTS**

The National Geographic Information Infrastructure (NGII) concept has been widely accepted by the geospatial community in Nigeria and steps have been taken towards its realisation.

### **5.1 President Obasanjo's Support**

A critical national need for improved means for finding and sharing geospatial data was recognised by President Obasanjo in 1999 when Nigeria returned to Democracy. The President, Olusegun Obasanjo approved the establishment of National Geographic Information Systems (NAGIS) and formation of inter-ministerial committee to monitor its implementation.

### **5.2 National Association of Geographic Information (NAGI)**

The Nigerian GIS community needs to be represented by an Association. The People in GIS in Nigeria have initiated the plans to form NAGI. Members are been drawn from GIS users in the private and public sectors, suppliers of software, hardware, data and services, consultants, and academics. The Association will provide a forum to stakeholders, experts and novices for discussing processes, problems and solutions to accessing and managing GIS. The NAGI's mission is three-fold:

- To provide excellence in education and information exchange on the use and benefits of GIS nation-wide;
- To maximise the use of geographic information for the benefit of the citizen, good governance and commerce; and
- To represent the broad interests of the Nigerian Geographic Information community.

### **5.3 Digital Mapping of the Country**

The Federal Survey Department has commenced the conversion of Analogue maps into Digital Maps and the establishment of National Topographic Database of the entire Nation. These are to ensure that digital geospatial data will be readily available as the framework upon which the NGII will be established.

### **5.4 Center for National Geographic Information**

Of the greatest importance in the development of National Geographic Information Infrastructure in Nigeria is to develop Centre for National Geographic Information Systems. The Office of the Presidency in National Planning Commission has been identified as the Centre for National Databank, which will house both the NAGIS and NGII. The Centre will undertake activities amongst others in the following three main areas:

- Promotion of the technology, its applications and its benefits for a wide range of interest groups
- Co-ordination and organisation of interest groups
- Information collection and dissemination.

### **5.5 Phase I - Completed**

The Phase I is the feasibility study and preparation of the project documentation. The purpose of the project document is to capture the main elements that will be involved in the establishment of the National Geographic Information Infrastructure (NAGII). These elements include technology, equipment, logistics, manpower, duration, methodologies, critical path and cost, etc. Phase I has been completed.

### **5.6 Inter-Ministrial Committee**

In the preparation for the Phase II, which is the full, fledged project implementation. An inter-ministerial committee has been set up with functions include among others, the following:

- To ensure that Phase II is in agreement with the project and national objective.
- To hold periodic meetings with the project management team.
- To provide meetings with the project management team.
- To examine periodic reports of the project management team.

### **5.7 Phase II**

Significant progress has been made towards the commencement of Phase II. It is planned that the full-fledged NAGIS and NGII will be operational by 2003.

## **6. LIMITATIONS OF NGII**

### **6.1 Institutional Framework**

In SDI, the institutional framework defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets. There is lack of cohesive framework for effective coordination of NGII activities, which is resulting in unnecessary duplication of efforts and outputs.

### **6.2 Technical Standards**

In the context of National Geographic Information Infrastructure, the technical standards need to be defined. This is because national spatial data infrastructure requires standards in each of the following areas: reference systems, data models, data dictionaries, data quality, data transfer, and metadata.

### **6.3 Lack of Adequate Funding**

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 NGII.

### **6.4 Telecommunication Framework**

The physical linkages, which will be the major access to the NGII systems will be through a range of mechanisms including dedicated telephone lines, local area networks, wide area networks and integrated-services networks. The telecommunication framework, which will give the community access to the fundamental datasets, is still posing significant problems. Although, with the introduction of wireless communication network telecommunication, significant progress has been recorded in data exchange and access.

## **7. RECOMMENDATIONS**

The recommendations are designed to provide a practical way forward in creating a National Geographic Information Infrastructure (NGII) to support Sustainable Development. The recommendations are

### **7.1 NGII Policy**

Considering the limitations, it is therefore, essential that NGII Policy should be put in place to guide the development of a national spatial data infrastructure. NGII Policy should include:

- Identifying fundamental land and geographic datasets
- Identifying custodians for those datasets
- Establishing operating policies for spatial data custodianship and distribution
- Providing a co-ordination mechanism for the data production and maintenance programs of the custodians
- Defining and supporting a national directory (system) for the fundamental datasets



- Facilitating the development and implementation of technical standards
- 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 datasets, and to co-ordinate cross-jurisdiction policies, standards and programs.

However, Nigerian Institution of Surveyors, Federal Surveys Department and Inter-Ministerial Committee on NAGIS are already working to ensure that NGII Policy is put in place for sustainable development of NGII.

## **7.2 Data Directory System**

The National Geographic Information Network is one of the benefits to be derived from the NGII for information distribution and access. The key element of the network is the data directory system, which should be freely accessible and contain highly accurate metadata for the fundamental datasets, including advice on gaining access to the data. It is recommended that National Geographic Information Dissemination (NGID) strategy should also be put in place. The strategy should include among others:

- Identify and visit geo-information establishments and other geospatial data needs in Nigeria, and study the existing infrastructure.
- Identify already acquired geo-information products and services.
- Identify and classify the geospatial data.
- Identify the fundamental datasets of critical national importance.

## **7.3 Educations and Training**

Education and Training are essential in designing and developing spatial infrastructure. The education and training may consist of in-house, on-the-job, local and international training in form of workshops, seminars and conferences. The training strategy is to design training to meet clear objectives, based on a training philosophy of "teach the right subjects, to the right people, in the right environment and at the right time". The education and training programmes are being developed to ensure the technical and management skills necessary to meet the challenges of designing, implementing and managing spatial data infrastructure.

## **7.4 SDI Implementation of Other Countries**

SDI implementation is different due to varying cultural, social and economic contexts within each country. However, there are a significant number of common elements that can be shared. Countries should avoid re-inventing these common elements. To a very large extent, the National Geographic Information Infrastructure of Nigeria has not achieved much when compared to the achievement of SDIs in other countries. The lessons learned in the development of the SDI in other countries should be adopted to solve the problems of the National Geographic Information Infrastructure.

## 7.5 NGII and Legal Aspects

The issues associated with national security, data privacy and associated liability pose significant problems for NGII initiatives. The Federal Government of Nigeria has been advised to establish legal frameworks and formulate appropriate legislation to address these crucial legal issues as early as possible.

## 8. CONCLUSIONS

National Geographic Information Infrastructure (NGII) is the key to planning and sustainable management and development of our natural resources 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 NGII 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.

## 9. ACKNOWLEDGMENT

We would like to acknowledge our invitation to participate as speakers along with more than 450 speakers with world-wide reputation in more than 110 technical sessions drawn from almost 70 countries at 2002 World International Federation of Surveyors commonly known as the FIG from its French title –Federation International des Geometres.

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## BIOGRAPHICAL NOTES

**Anthony Abiodun Adeoye** was born on October 1<sup>st</sup> 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, member of British Society of Computer (GIS Specialist Group), member of Computer Association of Nigeria and 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:

1. Authorship of the only/first Textbook titled “Computerised Information Systems for Surveyors” – the first and only book on the subject.
2. Authorship of the only/first indigenous Textbook titled “ Geographic/Land Information System – Principle and Applications – the first and only book on the subject.
3. The first Nigerian Surveyor to publish over 60 articles in learned journals within and

- outside the country within four years.
4. The first Nigerian Surveyor to publish two textbooks within two years.
  5. The First African Surveyor to Present a paper at the Commission 3 – Land Information Systems of the 1998 Internationale Federation des Geometria popular known as World Congress of Surveyors.

### 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.

#### 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 Anthony Adeoye & Co., a firm of Chartered Surveyors with areas of specialisation in Geographic Information Systems.