

An Overview of the Functions of Abuja Geographic Information System (AGIS) As a Tool for Monitoring Growth and Development in Abuja Nigeria

Ibrahim Sufiyan¹ Ahmed Mohammed Buhari² Usman Saddiq Abubakar²
Ahmed Y. Ubangari³

1. Federal Polytechnic Nasarawa, Dept Of Surveying And Geoinformatics
2. Federal Polytechnic Nasarawa, Dept Of Urban And Regional Planning
3. Nasarawa State Polytechnic, Lafia, Dept Of Urban And Regional Planning

Abstract: *The recent technology that substitutes the manual input data to digital data had enhanced growth and development in most of our cities through the application of geographic information system. This paper analyses the current assessment of GIS and its impacts on growth and development of the Central Area of Abuja. Geospatial data are required to evaluate the urban growth within the periphery of the study area, Federal Capital Territory (FCT). The impacts of human settlement and population, expansion of business activities, migration, and improved quality of health care and personal-social services are expected to be the contributory factors that led to expansion. The peripheral growths were dominated with development of slums while the central area experienced urban sprawl. Application of GIS on urban planning can ease the problems of both blight and slum growth outside the city, making it possible to monitor, access the settlement pattern and proffers solution where necessary.*

Keywords: *GIS, Urban Planning, Growth, Development, Population*

I. Introduction

The science of Geographic Information System (GIS) has to do with the computer system for storage, collection, managing and displaying geospatial data Chang (2002). The Abuja Geographic Information System (AGIS) is one of the development plan initiated by the Federal Capital Territory Administration (FCTA) with the objective of evaluating and planning the FCT master plan to digital satellite services for accurate surveying and allocation of both existing cadastral maps and government reserved areas in the Federal Capital Territory, Abuja. There are some major obstacles emanating from the growth of cities Akinjogbin (1985). The Federal Capital Territory came into being in 3rd February 1976 by the then military administration of General Muritala Ramat Muhammed. It officially became Nigeria's capital on 12 December 1991, replacing Lagos. Since its creation the city is experiencing expansion with significant changes in its physical landscape. The Nigersat -1 imagery 2006 expose the then change in many land uses. The territory is located on longitudes 8°50'N & 7°10'N and latitude 8°50' E & 7°10'E, east of the Greenwich Meridian. According to United Nation, about 50% of the world is urban. The criteria which sort this assertion is by looking at the urban areas or urban population. The urban population has sampled over 232 countries determined by the type of economic activity, physical characteristics, level of infrastructure, population size and population density. Urbanization in FCT affects the surrounding towns by high living standard and limited available resource Ekoh et al. (2006). The various transformations over the period of 11 years (1990-2000) and to measure the rate of urban expansion and loss of vegetation cover in the study area ifatimehin (2009). Aso Rock is a large monolith which reaches about 936 meters above sea level. It is the largest and tallest rock in Abuja. The Presidential Villa, National Assembly and Supreme Court are built around it. It also features a number of caves, which are open to visitors. The word "Aso" means "victory" in Gbagyi dialect. The Aso Rock and Caves hold significant importance in the culture and also have quite a few myths and stories associated with them. To date, they are

Katampe Hill: Katampe Hill is a granite outcrop and one of Abuja's highest points. It marks the geographical centre of Nigeria and offers a panoramic view of Abuja.

Ushafa Pottery Village: The Ushafa Pottery Village is a centre where the making of traditional pottery can be observed. The centre was established in 1991 as part of Maryam Babangida's Better Life for Rural Women project during her tenure as First Lady. It has since become famous as a stop for visiting heads of state and its pots are of commercial importance.

Abuja Millenium Park: The Abuja Millennium Park was commissioned to mark the Commonwealth Heads of Government meeting which took place in Abuja between December 5 and 8, 2003. Designed by Manfredi Nicoletti, an Italian architect, and dedicated to art and nature, the Park is set in 32 hectares and contains bodies of water and varied vegetation It is the largest of Abuja's green areas and parks and is located in

the Maitama district of the Federal Capital Territory. The Millennium Park was commissioned in December 2003 by Queen Elizabeth II of the United Kingdom.



FIG 2.Map of Nigeria showing the Federal Capital Abuja Territory (FCT)

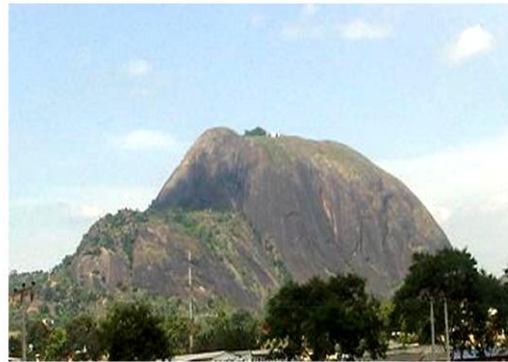


Fig 1 Aso Rock one of the physical features in

II. Methodology

The study focus on the use of the population and growth data from the Abuja geographic information system and it also employ the use of satellite data from the remotely sensed data available. We use ArcGIS Online to track the major build-up areas within the scope the study. Most of the data collected randomly in the area where new development and growth is currently taking place.

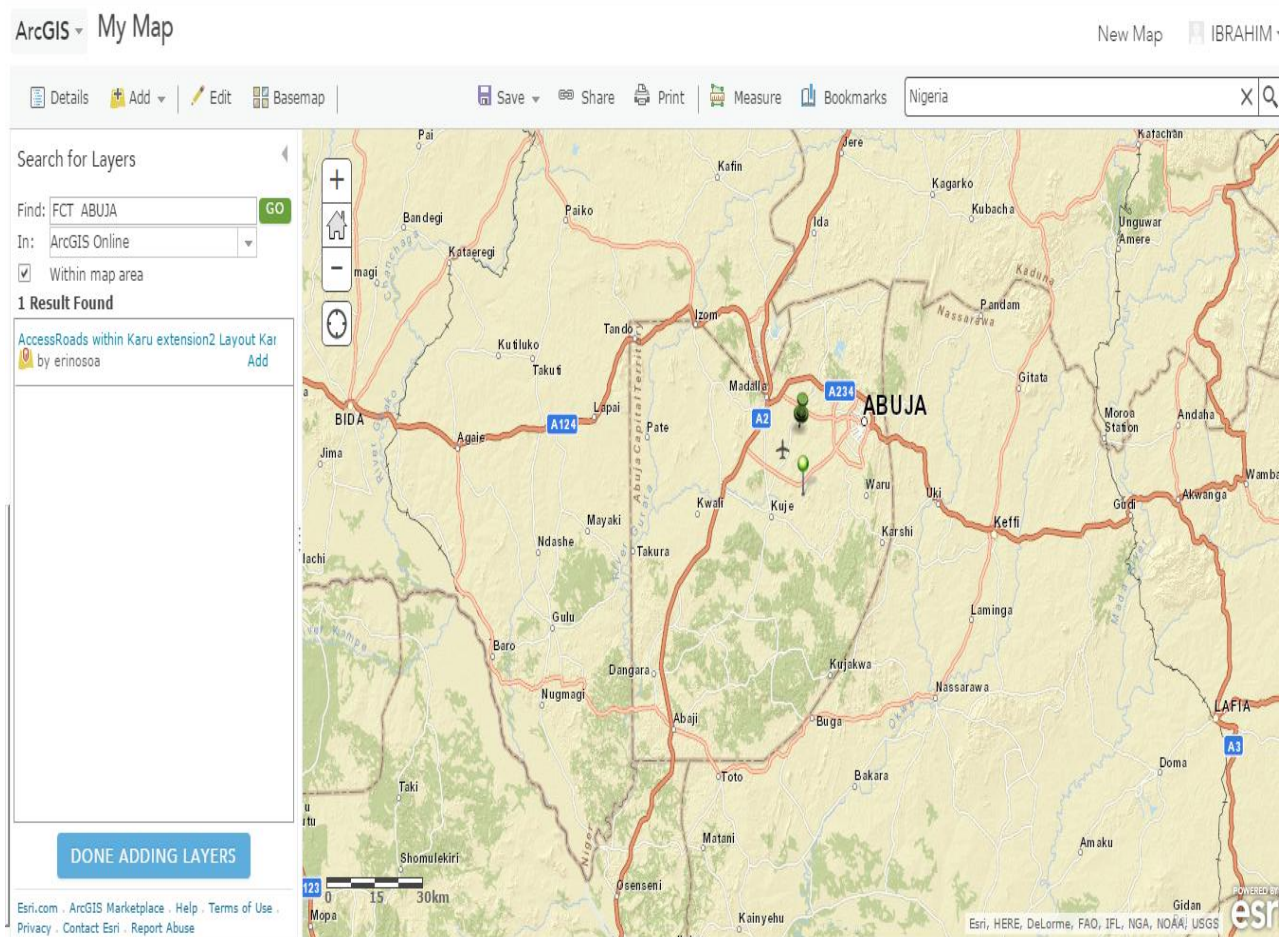


Fig 3.Web-Map of Federal Capital Territory (FCT)

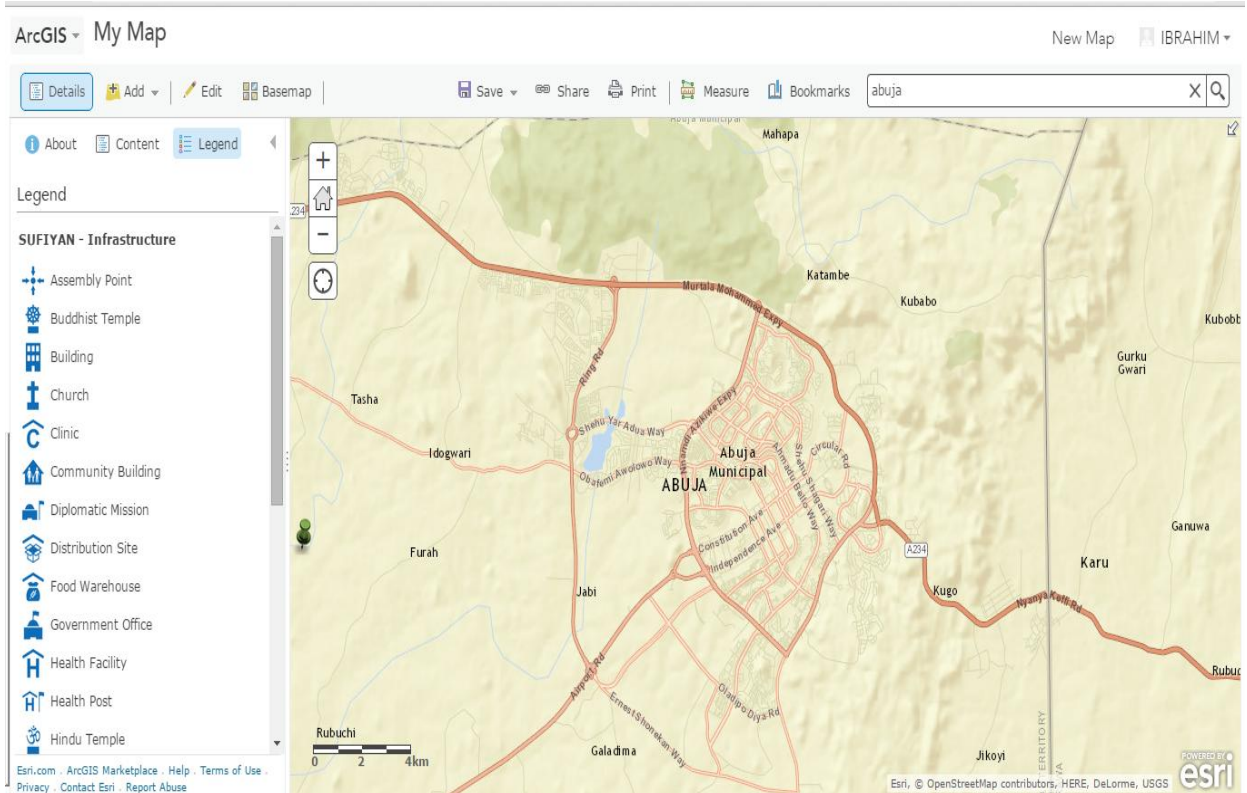


Fig 4. The selected zone using ArcGIS Online location of FCT

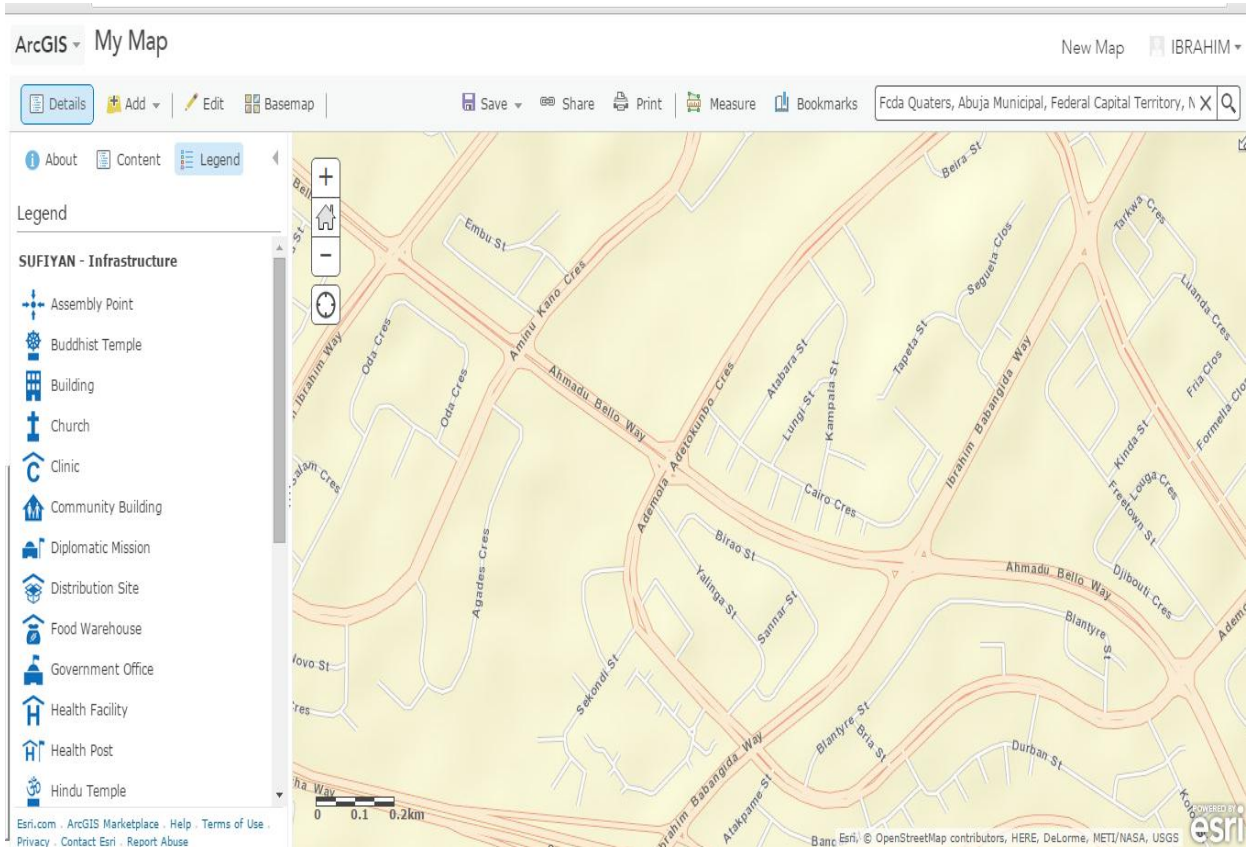


Fig 5. Open Street Map Web- GIS showing location of FCDA

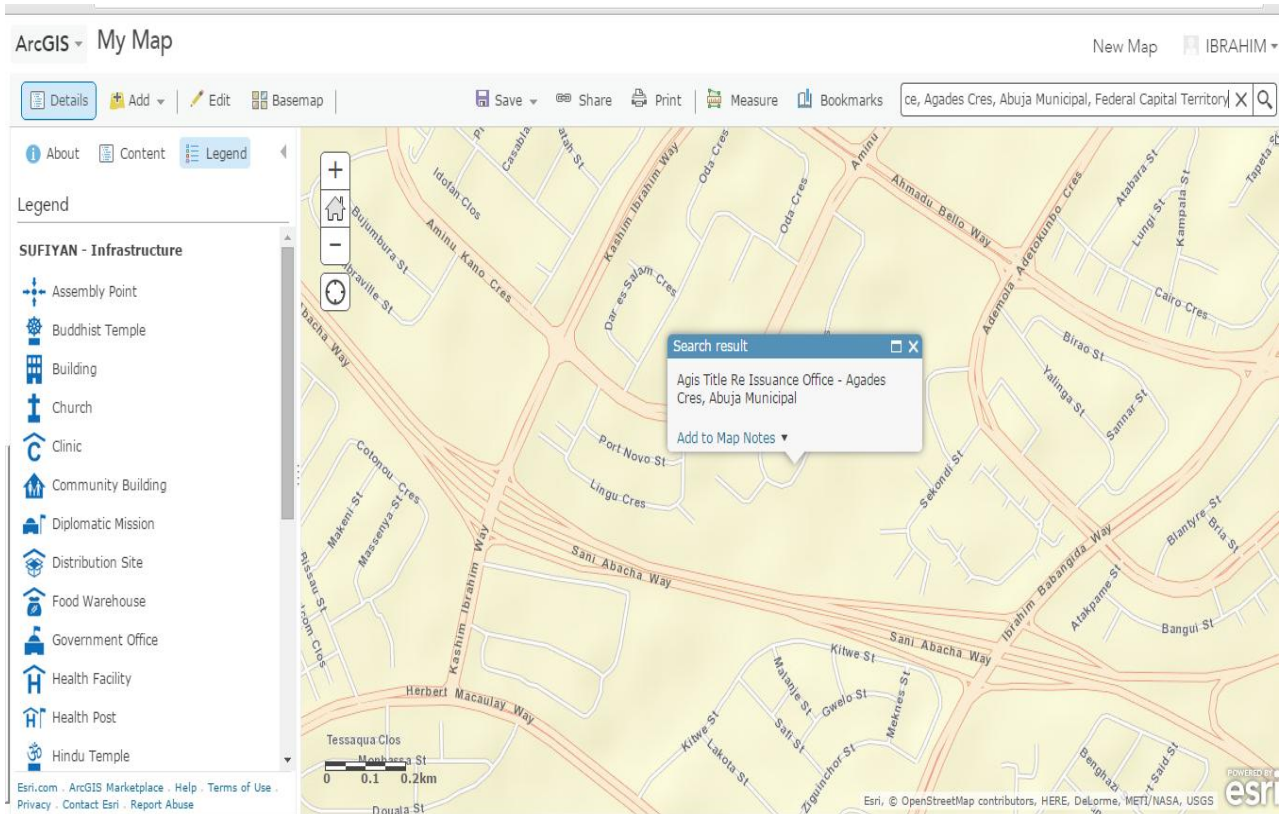


Fig 6.The location of Abuja Geographic Information System on Web –Map

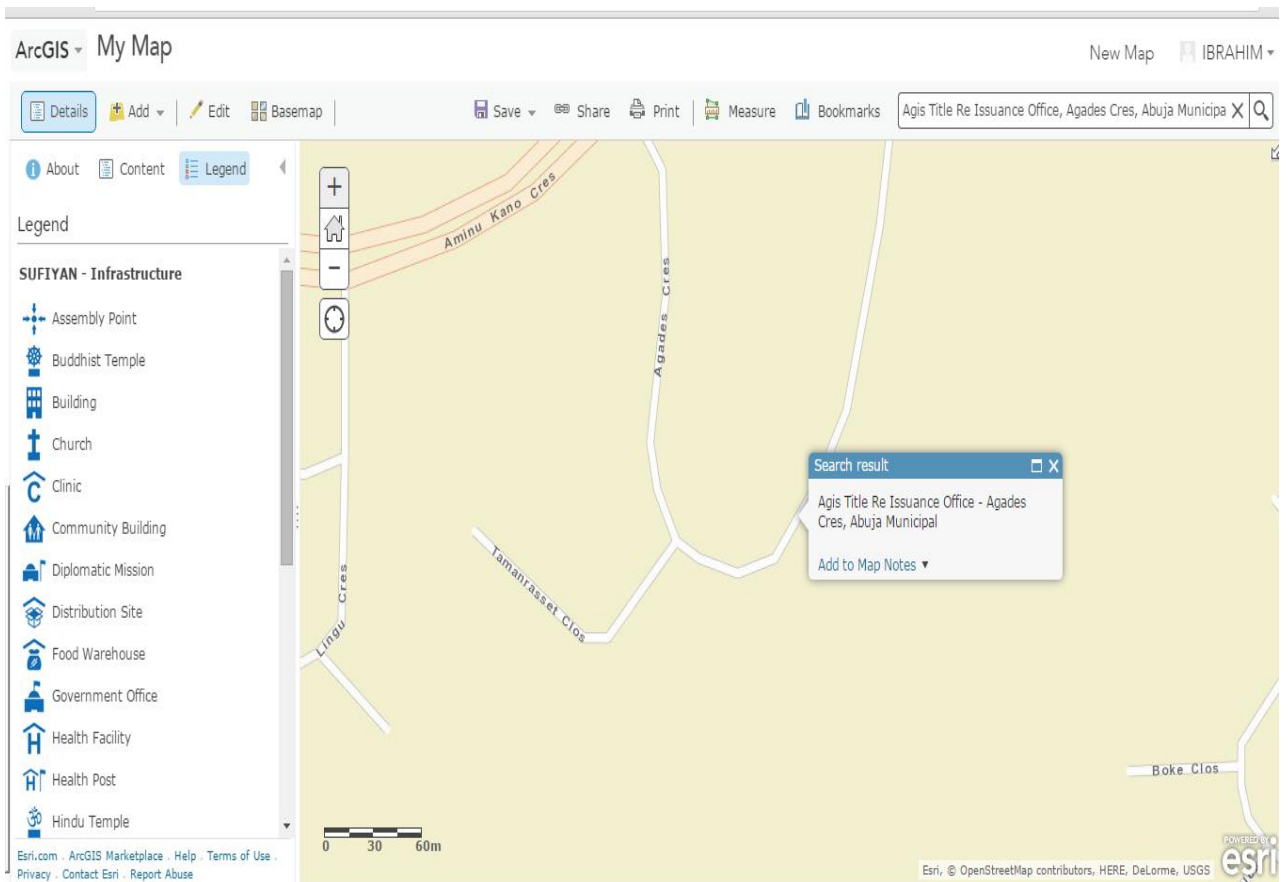


Fig 7.Using WEB-GIS to locate Abuja Geographic Information System (AGIS)

The Fct Urban Growth

The urban pattern based on the theory multiple nuclei theory and the concentric theory by E.W. Burgess of 1925 is not properly applicable in most of the developing countries. Land use cluster is more pronounced in cities with large concentration of industries, efficient transportation network coupled with business activities around the federal capital. According to Dai et al. (2001), geo-environmental evaluation for urban land-use planning often requires a large amount of spatial information. Geographic information systems (GIS) are capable of managing large amounts of spatially related information, providing the ability to integrate multiple layers of information and to derive additional information the population is expanding toward the satellite towns from 3.1 million in the capital to 2.6 million with insufficient accommodated city populations. This criterion is to provide enough housing to settle the un-accommodated population and those trooping en-mass due to insufficiency in rural areas and insecurity that cause forced migration particularly from the northeastern Nigeria. According to the 1991 population census (Provisional figures), the population of the FCT was 378,671 and is now (Year 2000) projected at over half a million. However, as it shows quite clearly, it was only 170,575 by 198

Abuja Geographic Information System (AGIS)

The federal Government of Nigeria in 2003 decided to make Abuja a model city with the intention to computerize the master plan and all the cadastral maps into GIS. AGIS is an established agency responsible in controlling cadastral and land registration. All matter related to land administration in FCT was handled and decisions are taken base on the reliable data. AGIS has become an icon of good governance with a transformative project of Spatial Data Infrastructure (SDI) for FCT. It is also extended it department to other agencies within the FCDA with the following objectives;

- Computerize the cadastral and land Registry for the Federal Capital City (FCC), the area and satellite Towns of the Federal Capital Territory (FCT)
- To provide a comprehensive, All-Inclusive, state-of-the-Art, Foolproof, Computerized, Geospatial Data Infrastructure for FCT
- The AGIS Resource Centre is operating; in the AGIS Building, as an independent service provider, as a professional GIS/LIS Resource Center, as the only official source for Geospatial Data on FCT, covering all of FCT, with revenues (additional revenues, not existing ones shifted to AGIS).
- AGIS should guarantee: Continuity, Scalability, Flexibility, Consistency, Sustainability and Reliability.

Using Population And Density Thresholds To Define 'URBAN' AREAS

The UN Population Division gathers the definitions of 'urban' population used in censuses in 232 countries. The criteria used by countries to decide whether to define a place as 'urban' include population size, population density, type of economic activity, physical characteristics, level of infrastructure, or a combination of these or other criteria. Some simply list their urban areas. Each definition may be well-suited to its own national context, but the differences present a problem when trying to compare urbanization across countries.

101 countries use minimum population thresholds as a means of identifying settlements as 'urban', either as the sole criteria or together with others. The most frequently used threshold values are 2,000 inhabitants (used by 23 countries), and 5,000 inhabitants (used by 21 countries), as shown in the figure below. The average of all these thresholds was just under 5,000 inhabitants. (It may strike you how low these figures are. The most frequently used minimum population, 2,000 people, could easily be accommodated within a single large office building.

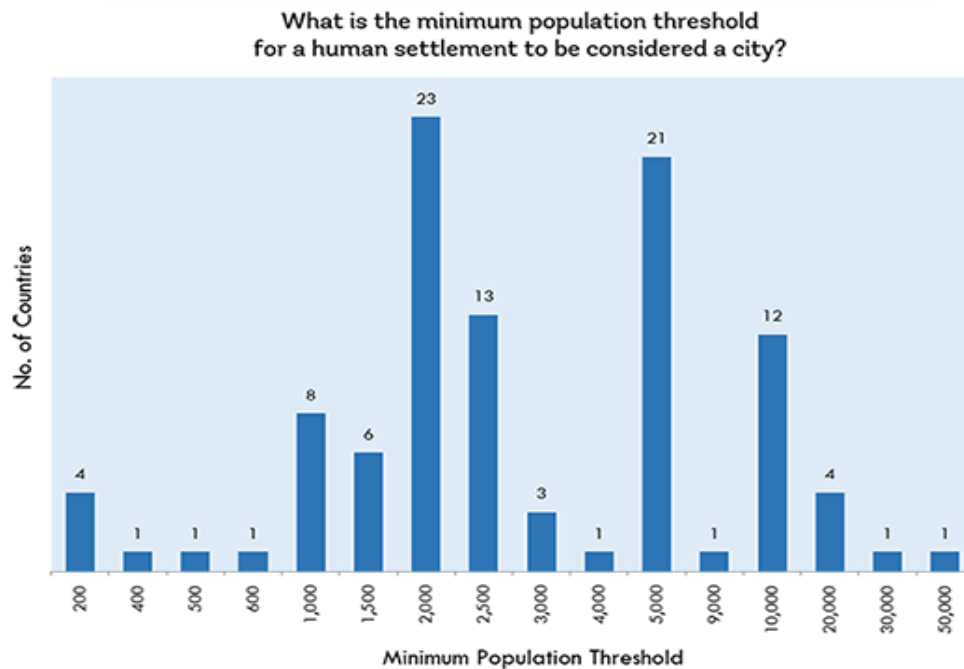


Figure8. Criteria for Urban Population threshold

Only 9 countries use minimum population density thresholds, of which only one, Germany, uses it as a sole criterion for defining urban areas. The lowest density threshold used is 150 persons per sq. km. (Germany), and the highest is 1,500 (China and Seychelles). The density thresholds also do not take into account the variation in the size of the areas over which the density is being averaged, which would result from varying sizes of administrative units. Even within the same country, two identical settlements may be treated differently, depending on whether they fall within large or small administrative units. The spatial urban parking spaces might need to be buffered in near future Oh et al (2007).

III. Discussion

The Infortance Of GIS In The Abuja Master Plan

Abuja became Nigeria's Federal Capital Territory in 1976; it has been experiencing rapid expansion, urbanization and significant changes in its urban landscape. Remote sensing and GIS techniques can identify, mark and measure the extent of change in the various land uses from the Landsat imageries of 1987 Ujoh (2011). According to Ango (2001) to rely on the original Master Plan would lead to the creation of a modern city with a clean and healthy environment whose residents would be free from pollution, traffic jam, congestion, filth, dirt, diseases, delinquency, and all the other things that make life miserable, unhealthy and hazardous for people. The Abuja master plan had undergone tremendous distortion since during the military regime in 1980 during the creation of Ministry of the Federal Capital Territory (MFCT) and been the super imposed on the Federal Capital Development Authority (FCDA). There is the issue of insufficient personnel to contain that master plan. The Abuja master plan was coordinated through well prepared land use, housing, transportation, economic, recreation, infrastructure and social services Abba (2003). The 1999 International Conference on the Review of the Abuja Master Plan highlighted some distortions (FCDA, 1999). Major distortions include the following:

- The ecological survey had underscored the fact that a large part of the territory was still infested with tsetse-fly whilst the river courses still provided breeding grounds for the simulium fly, the carrier of the disease vector giving rise to river blindness. To evacuate the entire human population whose farming activities had helped to keep down and destroy much of the habitat favorable to the tsetse fly was to compromise the future health status of the population of the new capital. The decision to evacuate all the inhabitants had to be revised and compensation and resettlement undertaken only in respect of those occupying the site chosen for building the city and the footprints of that development. This has resulted in the conversion of most of these villages to slums as they accommodate the lower cadre civil servants and other low-income workers.
- The initial implementation strategy for the Master Plan envisaged that the workers would be housed in the "Accelerated District" within the Phase 1 Area of the cities development. This "Accelerated District"

developed for low-income workers so as to prevent the emergence of shanty towns of construction workers in the periphery of the capital city was also to serve as a model for testing out the detailed plan concepts. This was also to prepare the city for a projected population of no more than 160,000 by 1986, the year when the capital was to be formally moved to Abuja. However, seeing the mass of buildings going up in the “Accelerated District”, the civilian government took the mistaken decision to rush the movement to Abuja by shifting it forward to the year 1982/83. This decision led to helter-skelter building activities within the city area. It also denied the planners the opportunity to test out the various plan concepts. As such areas such as Nyanya, Luge rose up to cater for the population influx.

- The post-civilian military regime preferred a presidential palace secluded away and closer to Aso Rock than in the middle of the central area of the city where it was located on the Master Plan. The presidential residence was meant to be located on one side of a national square that was to be the intersection of a central mall and a parkway and the National Square. Instead, the present Presidential Villa has usurped the site meant for the National Monument and this makes the beauty and grandeur of such a building no longer part of the prominent and salient feature of Abuja.

- Initially, building plots in the Federal Capital were allocated on some equitable basis of federal character. However, as geo-political biases became prominent in staffing of the FCDA, distortions became manifest both in the motives for allocation of building plots and in the distribution of allottees.

- The delay in constructing the transit way and introducing a rapid transit system to serve the City can be regarded as a distortion of the Master plan. This delay has allowed the right of way reserved for the transit way to be encroached upon through indiscriminate plot allocation in several places. This will create a lot of problem in the future for the development of the transit way for buses and eventually a rapid rail system.

- The Parkway Concept as a major element of open space system is gradually giving way to physical development in Phase I and II.

- Development of Green Areas/Hill Tops for Housing: These and other ancillary facilities are major distortions to the plan. At the same time, these buildings have enhanced the beauty of the city and have added to the housing stock of the city. There are also cases of incidental designs of residential layouts involving some minor redesigns mostly in areas reserved as green to meet the urgent desire for residential development.

In 2003, a Ministerial Committee on Illegal Structures in FCT was constituted to collate a list of all illegal structures in the FCT and present a strategy for demolition. Interestingly, most of the members of the committee were not professional planners.

Some of the distortions highlighted by Committee are presented below.

Distortions In The Implementation Of Abuja Master Plan

Phase I

TYPE OF DISTORTION	NUMBER OF PLOTS
Encroachment into Green Areas	84 plots subdivided and allocated as residential 30 neighborhood parks converted to corner shops
Encroachment on Sewer lines	70plots
Encroachment on Water pipelines	166plots
Encroachment into highway corridors	216plots
Development of residences on plots allocated for educational institutions	22plots

Source: Ministry of Federal Capital Territory (2003)

IV. Recommendation

Urban Primacy: Because most of the government establishments are located in the Municipal area of the territory, this part of the FCT has for long been enjoying the privilege of being a primate city. However, of recent, high land values within the municipal council is necessitating the drift, away of people and their activities to other urban and semi urban areas of the territory. Some policies of the government are causing some important government agencies and institutions to be located outside the Municipal area. For instance, several institutions under the Federal Ministry of Education are cited outside the Municipal area. With time, therefore, the primacy of the Municipal area will continue to diminish.

Public Enlightenment: the periodic awareness and publicity about the objectives of AGIS is paramount so that people will not violet the rules and regulation when allocation was done.

Organizing conference and seminars: the AGIS should organize national and international conferences, seminars and workshops, to allow professionals, Academia, staff training and other interested bodies to participate. This will increase the skill to burst the organization

Review of the Master Plan periodically: with the introduction of AGIS, the master plan of Abuja will be transform from 2D to 3D, and all digital maps can be accessed easily.

Adherence to Urban Policies: Abuja like any world major cities have to adopt policies of urban development so that it growth will be monitored including the satellite Towns.

Making the FCT a Sustainable environment: it is not an easy process to obtain a sustainable city due to the relativity of the term. In future we may assumed to have reached the some stages of sustainability

V. Conclusion

The emergence of geographic Information System GIS, has contributed in collecting, storing, analyses, manipulation, accessing and displaying geospatial data of the Federal Capital Territory (FCT). The urban growth was monitored through urban population, size and density within the city and the satellite Towns. Demolition and upgrading have changed the content of the master plan. Notwithstanding, the approach of getting to become a sustainable city is on the pipeline. The Abuja Geographic information System (AGIS) was the hard core in coordinating all the georeferenced data pertaining cadastral, Registry, surveying and allocation. In near future there is need to expand the Master Plan so much so that the FCT will accommodate peripheral population growth.

Refernces

- [1]. Akinjogbin, I A, Adediran, Biodun. (1985). Pre-colonial Nigeria: West of the Niger. Nigerian History and Culture, 35-55.
- [2]. Abba (2003) Saving the City of Abuja from Dirt, Faeces, Garbage and Disease. *Indepth Analysis* Vol 3, NO 5 Nov 2003
- [3]. Ango (2001) implementation of Master Plan: The Abuja Experience 1979 1999 in FCDA: THE REVIEW OF ABUJA MASTER PLAN. Ibadan: Foundation Publication
- [4]. Chang. (2002) Introduction to geographic information systems. Book, McGraw Hill companies,
- [5]. Dai, FC, Lee, CF, Zhang, XH. (2001). GIS-based geo-environmental evaluation for urban land-use planning: a case study. *Engineering geology*, 61(4), 257-271
- [6]. Ekoh O, Innocent O and Ogbonnaya O (2006) El-Rufai and Abuja Urban Renewal Policies: An Independent Study Crystal Print, UK Ltd.
- [7]. Federal Capital Development Authority (1979): The Master Plan for Abuja - The New Federal Capital of Nigeria
- [8]. Federal Capital Development Authority (1999) Papers Presented at the International Workshop on the Review of Abuja Master Plan
- [9]. Ifatimehin, Olarewaju Oluseyi. (2008). Remote sensing and GIS applications in urban expansion and loss of vegetation cover in Kaduna town, northern Nigeria. *American-Eurasian Journal of Sustainable Agriculture*, 2(2), 117-124.
- [10]. National population commission 1991 census data Abuja
- [11]. Oh, Kyushik, Jeong, Seunghyun. (2007). Assessing the spatial distribution of urban parks using GIS. *Landscape and urban planning*, 82(1), 25-32
- [12]. Ujoh, Fanan, Isa, D, Olarewaju, O. (2011) Urban expansion and vegetal cover loss in and around Nigeria's Federal Capital City *Journal of Ecology and Natural Environment*, 3(1), 1-10.