SATELLITES APPLICATION TO ABUJA (FCt) MASTER PLAN IMPLEMENTATION MONITORING

BY

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CERTIFICATION

This is to certify that this study was conducted by FABIYI, OLUSEYI OLUBUNMI of the Department of Geography under the Suppervision of Dr. G.N. Nsofor.

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DEDICATION

This work is Dedicated to the Glory of the Fossessor of heavens and, the earth.

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ABSTRACT

The need to improve the quality of urban system in order to save the urban centres from continual distengration prompted the use of master plans. The soci9-economic and physical p~oblems that characterise unguarded rapid urbanization manifest in uncontroll~d urban sprawl; 'slum development, inadequate recreational open spaces; poor ~irculation\ which *ofte«* serves to impede move.ment ,human and vehicular' poor maintenance of circulation, unemployment , crime, inadequate housing units as well as over crowding in the available ones with visibly abused and assaulted environmen~ .t. is very disturbing and damaging to urbanscape. Master plans serve as useful tools to ensure desirable development of the urban areas. However the propensity to prepare master plans in Nigeria is not met with equal desire to implement them.

The satellite remote sensing is used in various aspect of earth related desciplines, in gathering, and monitoring earth data.

This project examined the use of SPOT satellite data (image map) in monitoring and tracking the implementation of Abuja master plan on stage by stage basis.

It was discovered that there were deviations of varying categories observable in the implementation of the master plan. The deviations were categorised into three viz. eviation by deplacement, eviation by ommission and eviation by substitution.

The percentage deviation ranks in the order listed above.

Recommendations were advanced on the integration of satellites in to the development control system in Nigeria.

Fabiyi 1995.

CHAPTER ONE

INTRODUCTION

1.0 GENERAL

The evolution of space vehicles brought about significant improvement in application of remote sensing technology to various disciplines. Important among the multifarious uses of satellite borne sensors are their uses in weather prediction, crop for~asting, mineral exploration, pollution detection, land use and land cover monitoring

The use of space-borne sensors to gather earth-related data for urban planning purposes has specific advantages over the conventional methods. These advantages range from its ability to provide up-to-date, repetitive data on a global scale to possibili ty of collecting data without the ;bottlenecks ii of formal permission from the sovereign nation.

Preparation of master plans is one of the major activities of urban planners, and it remains the most effective tool of achieving desired goal in cities (bhoakhoraye and Omuta 1980). It is often employed to ensure functional urban system. The preparation of master plans involves acquisition of numerous geographic, economic and social data. The use of remote sensing for gathering these data has been very encouraging.

Many master plans prepared in Nigeria are often neglected on

shelves togather dust and sometimes when the plans are implemented the experience has been gross deviation from the "spirit" and letter of the master plan document. The deviation can be deliberate or consequential.

These call for real-time spatial data in order to estimate the level of implementation of master plans, test the consequences of deviation and make necessary adjustment.

Satellite remote sensing has come - of age in providing spatial data on a repetitive basis. Remote sensing satellites have been designed according to their application for uses in either the study of the earthis resources or for meteorology. (Lo 1980; Curan 1985; Haws 1987). Meteorology satellites can generate data about the earth for as much as twice per day while the earth viewing satellites can give data of the earth every te !days or less (Imberti, 1994).

These possibilities of the satellite remote sensing is of immense benefit to solving urban problems. The peculiar dynamic lature of urban phenomenon demands an effective system of mapping ~hese changes.

study therefore focusses on investigating the)ossibilities of integrating the repetitive, real time acquisition)f data by remote sensors on board of satellites, for timely letection of deviation/contravention in the execution of master i.Ians,

~.1 STATEMENT OF PROBLEMS

With the tremendous improvement in the application of satellite remote sensing to earth-bound disciplienes it is important to ask the following questions.

(a) Is it possible to use photo interpretation of satellite data to estimate the level of implementationand/or the degree of deviation from original document of master plans.

(b) What is the level of compliance in the implementation of Federal Capital city (Abuja) master plan as at 1990.?

1.2 THE STUDY AREA

Federal Capital city (FCC) plan is an Adjunct of the F.C.T. Master plan (Federal Capital Territory). The idea of this plan was consumated with the establishment of F.C.D.A. (Federal Capital Development Authority) *in* 1975. The aim of this exercise was to relocate Nigerian capital city. Abuja was chosen to replace Lagos after serious consideration of some factors such as:

a. The congestion that characterised Lagos as it functioned as both a Federal capital and a state capital with the inadequate landspace.

b. The need for ethnic neutrality of a nations capital

c. The need for a new capital that will serve as a symbol of Nigerianis aspirations for unity and greatness.

d. The need for a centrally located nationis capital.

With these objectives the Federal government agreed that a centrally located Federal capital *in* a spacious area with easy

access to all parts of the federation would be an asset to the nation and would help in generating a new sense of national unity.

The site for the Federal Capital Teritory of which the Federal Capital city consists is an 8,000 square kilometer area south of Abuja (former) surrounded by Niger, Kaduna Plateau and Kwara states. See Map 1.

From the F.C.T , the capial city was carved out after a systematic analysis of natural and manmade resources of the federal capital territory. The p1"votof the site location criteria are as follows.

a. Urban suitability; which relates to investigating how some environmental factors will support, allow and prompt development of the city. The factors considered are soil characterstics, vegetation quality, geological characteristics, probable conservation zones, quality of climate and suitability terrain.

b. Visual Amenity; this relates to imposing or unique natural features or general attractiveness of the environment.

c. Man-made constraints. this relates to the factors of resources and infrastructure. they were evaluated on the basis of the following: airport approach, and departure zone, highway corridors, probable size of urbanized areas, and water, power, and waste disposal requirements of the New capital.

The selection process yielded a site 1~Okm from Shiroro, 1BOk~

from Makurdi 150km from Lokoja Map ~.

The site is the Gwagwa plains in the North eastern quadrant of the federal capital territory. It is bounded by Abuja-Hills to the west, the Zuma-Bwari- Aso Hill to the North, the Kanu - Agwai Hills to the east and the Zango Kuku Hills to the South Map 3 Shows the location of FCC in the contex of federal capital Teritory.

1.~.1 Climate

The climate is very comfortable for living. The temperature is highest in the dry seasons when there are few clouds. Changes in temperature of as much as 17°C is recorded. This is greatly influenced by the humidity conditions in the air. Relative humidity falls in the afternoon to as low as ~0% in the city site zone. tfhiS low relative humidity, coupled with the high afternoon temperatures, account for the dessicating effects of the dry season.

The Length of Rainy season lLRS) of the study area is between IH0 days to 190 days. Fig.1 shows the mean monthly Temperature, Humidity and Rainfall for the zone where the study area falls.

1.2.2. Wind - Dust

There are two major air masses predominant in F.C.T. These are the tropical maritune air mass and the tropical continental air mass. The former air mass which is warm and moist, emanates from the atlantic ocean and moves inland in a South-west to Northeast direction. The other air mass has its origin from Sahara desert.

It is warm and dry blowing from North-east to South-West direction. The latter is a dust-laden wind and gives the site its characteristics climate. The dust particl~s reduce visibility to a few hundred metres during some seasons.

1.~.3 Sun and Cloud cover

The capital city site is exposed to ~,500 sunshine hours annually (Mabogunje 1977) as quoted by Abuja master plan.

During the dry months (November - April) the monthly variation in the amount of sunshine follows the general trend of an increase from over ~75 hours on the city site.

1.3 AIM OF THE STUDY

The study investigates the possibiltities of employing satellite image interpretation in the Development Monitoring and early detection of deviation in the implementation of master plans.

1.4 THE OBJECTIVES

The primary objectives to achieve this aim include:-

a To assess the level of compliance in the imple~tation of Federal Capital city (Abuja) master plan through SPOT satellite image processing.

b. To examine the factors responsible for deviation in the implementation of Abuja master Plan.

c. To succinctly organise the result in a format to assist in integrating satellites images in the implementation of

master plans.

d. To profer ways of effective monitoring of development in Abuja (FCC).

1.5 NEED FOR THE STUDY

Most of the master plans that have been implemented or in the process of implementation in Nigeria experienced certain degree of deviation. These deviation from the original proposal can have grave consequence on the functionality of the cities.

As it has been pointed out earlier some of these deviations are deliberate while some are consequential. Which ever case, up till date no adequate tool is available to detect the deviation or the impact of the deviation on time. It is thus impossible to test the consequence of deviation on the overall development from the agency;s office.

This project attempts to provide means of tracking the physical developmental process of an urban area through earth viewing satellite data. It further profers, solutions to some of the multifarious problems plaguing the implementation of master plans.

CHAPTER TWO

LITERATURE REVIEW

2.0 General

The vogue in urban planning is the preparation of master plans as an instrument/tool of ensuring the orderly development of cities. Master plan is given various names such as ~mprehensive plan, General plans, Development plans e.t.c. Just as various names were attributed to master plan, variant of definitions were advanced in order to properly describe/define master plan. {' Kent Jr (1964) defines it as "t.he official statement of a municipal legislative body which sets forth itjs major policies concernning desirable future physical development;;, The definition suggests a document that contains official decision on the direction of city growth.

(19BO) defines it as "T'he plan of future course of development of a city considering its soico-economic, physical, cultural and political administrative char-ac.e-La.Lcs!". This approach to define master plan purported by Agaba is broad in scope

and can consist of any governmental policy statement that aims at acheiving a desirable future for a city or community.

The object of controversy is the amiqui ty of the scope of master plan, while master plan can cover as small a place as an estate, working drawings for a park e.t.c. It can also be as broad as the master plan of cities, region etc. Nevertheless the name ;master pLans" seems replaced with development plans as the scope becomes more regional. (Black, U:l6H).

Irrespective of the discrepancies and controversies in the choice of name and scope of master plans,there are various characteristics that are peculiar to master plans as generally agreed by all planners. These are:-

a. A master plan must be comprehensive, in order word it must embrace all geographic parts of the community and all functional elements which bear on physical development.

b. It must be general, in the sense that the plan summarises policies and proposals and does not indicate specific locations of detailed regulations

c. It must be long range; having to look beyond the foreground of pressing current issues to the perspective of problems and possibilities; twenty to thirty years in the future.

These attributes of master plan elevate it above other tools of urban planning. It deals with the town as a whole both in elemental contex and physiographic context, taking into

consideration the interelationship between the element of city (planning area) and the geographic components. (AgabaJ.O. 1~80).

Master plan includes sets of drawing representing design proposals, reports of policies to ensure the compliance with the planning statement, the legal frame work upon which the policies will be implemented and a statement of the duties of the implementing agency(ies).

Master plan as a tool to ensure desirable city setting in Nigeria has been used as an approach whereby a planning agency operates programme a thought to attain some objectives with certainity. It ensures general allocation of the cityis space or land area to major land uses. Due regard is however placed on the interrelationships and implications of one type of use in relation to other uses.

It is therefore a" posi tive long-term land use development planning for a given city or region and it assigns the various areas to types of uses and forms of uses.

Urban planners have evolved various instruments to assist the actualization of the proposals of the master plans. hese tools are often used in the absence of master plan as ad-hoc approach to planning or what is termed as iidisjointed incrementalism approach (Lindlom, 1~5~) to urban development. Such tools include Zonning ordinance official map and sub-division regulation which are intended to carry out the proposals of the master plan.

Other tools include planning scheme, Development control, capital improvement programmes, budget allocation special purpose

regulations and middle term or short term development plans. This aims at concentrating on a particular area of the city or a particular functional element. It has shorter time perspective.

Master plan of a city may include the planning of social, economic, administrative and fiscal matters .Many of which are obviously interelated to physical planning.

Fagin ~ (1959,) purported that a physical plan and all other sorts of plans should be unified in an ultra-comprehensive "policies plan", However some opinied that master plan should confine its scope of city planning to physical development. This traditional scope of master plan only identify with location, size and spatial relationship.

Muench .(1972) noted that there are two basic approaches to urban planning. first/y tradition Ji't/hat relates with the physical development in particular with technical and design aspects, and secondly applied social-scientific which relates to the spatial economics of physical development and its social meaning. Most of Nigerian master plans deal more with the former than the latter.

2.1 Significance of Master plan for urban Development.

Without proper regulationn of the city growth, the developers will build ;;anyhow;;which can result to a chaotic and disorderly growth of the town. Such disorderly growth may result to enchroachment on adjoining properties denying to them access, natural light, privacy and ventilation, lack of access for public facilities such as water mains, sewer lines, electrical wires

telephone cables and other infrastructure elements.

One of the effective ways of dealing with cities, preventing them from degenerating to these levels is to prepare a comprehensive master plan as a guide for future course of action and development.

A well prepared master plan will identify inherent problems and formulate proposals for the improvement of the already built-up areas in the foreseable future.

The subject of coverage of master plan is still subject to controversy, According to Wuredu (l~H~) the features of. the masterplans in Nigeria is left to the convenience of consultants. In a review of the subject of coverage of Akure, Benin, Calabar and Kano Master plans, he discovered that they threat different aspects, the discreapancy is shown in the table below.

Table 1 Table showing subjects covered by some master plans in nigeria.

Report	Akure Master Plan	Benin	Calabar	Kano
	Existing Land use Housing & population	Population Housing, Land use	Demography Housing, Transporta	Population HOusing services Commerce

economic Base	(CBD cityltion	& Eco	Industry
Education and	structure	nomic	Agriculture
social feature	Economy	activitiesl	Communication
transportationl	services &	Geographyl	Economy.
public	facilitesl	Geology	
utilies	traffic	Natural	
	& Transp.	Resources	
	sites & Building of Historic importance		

From the table above some of the plan covers seven subjects, while others nine, the problem of lack of agreement on the subject of coverage is a potential set back in applying a common yardstick or standard for measuring the implementation of the master plan.

Series of agencies and statutory bodies were aimed with laws and legal provision to ensure the total complaince with the proposals of the master plans. Planning authorities, urban development boards e.t.c. are some of the bodies responsible for the implementation of the master plans in nigeria.

2.2 Master Plan Implementation

Without effective policy to implement master plan, the proposals, however laudable and brilliant they may be, remain like a glossy book that is meant only for the shelf. Hence various apparatus are usually set in motion for the implementation of master plans.

Nigeria has an interesting history of planning experiences with the characteristic fashion of evolving tools and guiding principles to ensure the right use of land in Nigeria. The first of its kind came in 1863 with the Towns improvement ordinanace, which was published in Lagos. It was meant to control development and urban sanitation in Lagos. In 1917 the scope of the ordinance was extended to cover the entire country and renamed as Township ordinance. A sanitation body LLagos Ex~e Development Board (LEDB)J was set up in 1978 following the enactment of Lagos Town Planning ordinance. The body emerged as the first planning development authority with powers to undertake comprehensive land-use planning and development in Lagos. In 1946 a Nigerian Town and country planning ordinance was adapted to *193t!* British Town and country planning This ordinance was adopted by the different regions in the country.

In the northern part of Nigeria it was adopted as chapter 130 of the laws of Northern Nigeria. It was named chapter 155 in the East and chaper *1t!3* of the Western Nigeria laws. This law remained the major legal basis for town and country planning in Nigeria until the *199t!* Town Planning law of Nigeria was put in place. Ola(1977)

The town and country planning is in the concurrent list of the Nigerian constitution which means that both the federal and the state government may carry out the responsibility. The federal ministry of works and housing has a town and country planning section that takes care of implementing the federal master plans

such as Federal highways constructions, major projects like Dam construction, plant installation. Some Federal government parastatals have their physical plannning/development units that handle implementation of their respective master plans.

However majority of Town and country planning activities take place in the state and local levels.

Every state in Nigeria has set up institutional framework for town and country planning involving two or three tiers. These include state ministry; which has the responbsibili ty for Town planning policy ;formulation and monitoring of the activities of the other areas. The other tiers are the Zonal planning offices and the local planning authorities which are responsible for town planning policy implementation. It however varies with states.

There are also some specialised bodies charged with the responsibility of a planned satellite towns such as Ajoda New town d~velopment Authority, Ibadan, Federal capital Development Authority-Abuja, Ogun property investment corporation (OPIC) along Lagos Ibadan express road.

Some states have urban Development board having under them local planning offices which oversee the implementation of policy drawn-up by the board; example of such states are Borno, Kano, plateau among others.

Most master plans in Nigeria performed poorly due to lack of effective procedure and machinery for implementation. The machinery may be strong, but lack tools for proper handling of task assigned to them. There has been a general bulk passing on who is

responsible for the failure in the implementation or the deviation from the original proposals of the master plan. Onokaye and Omuta (19H6).

Alterman and Hill (197H) blame problems on the lack of proper link between plan and plan implementation. The situation has not completely changed as the consultants employed for plan making are usually not available for consultation during plan implementation.

Hobb and Doling (1981) observed that the cause of the problems is the incompetence of the professionals whose undue concern is in making plans without a corresponding concern to see them carried out. One would readily agree with their submission as critical analysis of many master plans currently available in Nigeria would indicate. The plans demonstrated the vision of the professional for an ideal state without consideration of the policitical religious, cultural and social content of the people.

Plan implementation according to Mc loughlin (1969) can be succinctly summed up as "a control activity where control is that which provides direction in conformance with the plan or in other words the maintenaance of variations from system objectives within allowable limits. In this context, plan implementation involves series of action (or statement of actions) aimed at translating the policies stated in the plans into realities of earth, brick and concrete and the translation of development strategies and growth models into the daily life concerns of housing, shopping, recreation and others 19H8).

The process of master plan implementation can be categorised into 3 stages which are:

1. The input stage: This relates to the identification of resources commitment.
2. The action stage: This correspond to the ability to make the input realise the goals of the plan.
3. The output stage: This is concerned with the respective planning efforts on the ground.

All these stages can be affected by multi-farious factors ranging from economy to political, cultural etc.

2.3 Factors Affecting Implementation of Master Plans in Nigeria

As mentioned earlier, master plans are poorly handled in Nigeria in terms of implementation. These stem from the following reasons as outlined by Agaba J.O. (1980)

i. Physical problems: Topography soil type, waterlevels and other physical constraints makes evelopment difficult and expensive. This, in a way, slow down the pace of work or cause deviation in the implementation of plan proposals.

ii. Economic: Revenue allocation for individual authorities cannot be predicted in advance Implementation largely depend on the release of funds by policy makers who usually weigh

the implementation of plans with other pressing commitments.

iii. Social problems: Pahl (1975) observed that the interest of the planning authorities often conflict with the developers. Nigerianis case is not excepted. Thus the views of developers about the planning policy is a form of unnecessary barrier that must be overcome in order to bring plans to fruition.

iv. Personel problems: Untrained hands are allowed to handle planning matters and implementation of planning proposals. This is due to the fact that trained planners are scarce across the nation thus professionals in allied field are usually employed to handle planning matters. consequently the planning proposals are being politicised and incom petent people dictate the direction of implementation.

v. Technical problems: This relates to logistic problems that millitate against many planning authorities. Some lack the necessary vehicles and equipment to properly handle the task.

vi. Research and Data problems: Up till now most of the planning authorities and agencies do not have effective system of storing data

about land use and land cover. Where such data exist the data are not dynamic enough to satisfy the need of the agencies, hence many problems and contraventions have reached their advanced stage before they could be detected.

vii. Conflict among professionals: - There is a conflict of power strugle among professionals that are involved in plan implementation. Professionals like the architects, engineers, surveyors often claim to handle the work of implementation and planners usually fail to declare their boundary of professional scope. The decree No.3 of 19HH gives legal backing to the scope of professional plannes. However the decree has not been properly implemented.

vii. Lack of co-ordination:- The preparation of Master plan usually involve few agencies and persons. The consultants usually consult few agencies during the draw-up of plans.

Other problems militating against implementation of master plans are: Multiplicity of agencies, inadequate Development control system, political factorsk, legal problems and time factors. These among others have substantially contributed to non-performance of implemenation of master plans.

2.4 Potentials of Satellite Remote Sensing in Master Plan

Implementation Monitoring:

Remote sensing has been variously defined by authors. The definitions defers with author; s background. However, a comprehensive definition was drawn up by Short(19H2) Remote sensing, according to him is the acquisition of data and derivative information about objects or materials (targets)located at the Earthis surface or in its atmosphere by using sensors mounted on platforms located at a distance from the target to make measurements usually multispectral) of interaction between the targest and electromagnetic radiations;;

From the above, it is noted that the analysis of the data and derivative infromation obtained through remote sensing activities determin~the useability of the information.

The deviation of geographic information through the use of remote sensing devices contribute immensely to the advancement of understanding of human activities and their act on the environment. Chorley (19H7) describes geographic information as "any information which can be related to a specific location on the ear-ht". This spatial informaion covers a large range which include the distribution of natural resources (Soils, Water, vegetation) the location of infrastructure (roads, buildings, utilities) political administrative and ownership boundaries

2.5 Geographic Information System

Prior to the advancement of remote sensing, maps which shows

rivers, roads, villages, forests relief were used to delineate natural features.

There were also thematic maps to describe natural phenomenon and features (e.g. a geological map) as well as human activities (e.g.unemployment rate) and can be a tool for landuse/resources management.

However the use of printed maps was fraught with many disadvantages, which are enumerated as follows (adapted from E. didon (1990)

1. Map making is costly and time consuming
2. The amount of informaion a prined map can contain is limited and the information itself often has to be constricted.
3. Once the map has been made and is published it remains a static document that cannot be updated before long. Updating implies repeating the task of map making from the start.
4. Retrieval of information from map is very difficult due to its complex nature
5. Quantitative spatial analysis is difficult if not impossible
0. Analysis involving two or more spatial data sets from different maps such as soils, slopes and vegetal cover is very difficult.

These problems plaguing the use of map to describe geographic phenomenon led to the development of Geographic information system

(GIS) which is the ʜSystem for capturing, storing, checking integrating, manipulating analysing and displaying data which are spatially referenced to the earth. This is normally considered to involve spatially referenced computer data base and appropriate application sott.warʺeehOrley 1987. In essence G.I.S. is a computer software package for management and analysis, display and storage of earth phenomenon.

The advent of satellite remote sensing pricisely in 1972 when the first civilian satellite was launched to observe the earth from space, brought a new line of research of integrating the G.I.S. into satellite remote sensing, since the satellite images have become a valuable source of up to date information on the surface of the earth. The integration of these complementary techniques (Image processing software and G.I.S. software). has been invaluable in monitoring changes such as desertification, erosion, forest fire, flood, urban land uses etc.

2.6 Satellite Remote Sensing

From the late 1960s an astronomical advancement in remote sensing was ushered in with the missions of both space vehicles and aircraft to acquire data with the additional abilities of sensors being able to observe target from more than one wave band. The 1960s saw the birth in weather satellites. The launching of TIROS-1 lTelevision and infrared Reflected Operational Satellite) in 1960 represents the beginning of civil satellites for weather observation. This was followed by ESA(European space Agency) and

Noaa (National Oceanic and atmospheric Administration) satellites at the end of the decade.

Other manned space progrmmes were launched and they offered immense improvement to the development of space remote sensing.

A significant progress was made in the last three decades as the space remote sensing graduated from observation of meteorological phenomenon to earth resources inventories. The Launching of ERTS lEarth Resources Technology Satellite in July 23rd 1974) which was renamed Landsat 1 represented a formidable surge in the experiments of space-borne sensors.

Landsat 1 represented the first unmanned satellite specifically designed to acquire data about earth resources on a systematic repetitive, medium resolution, multispectral basis. It was initially used to experiment the feasibility of collecting earth resources data from unmanned satellites. The resounding success prompted further experiment that culminated in the launching of Landsat 2 to 5.

Landsat satellites were launched with powerful remote sensing system on board. The sensor on board has (a) a three channel return beam vidicon (R.B.V) system.

b. Four channel multispectral scanner (MSS) system.

The R.B.V. system has a normal ground resolution of about HOm and the spectral sensitivity which can be broken down into 3 bands. In the electro-magnetic spectrum viz; green, red, and reflected infrared. It is thus possible to obttain images that have greater inherent cartographic fidelity than those obtained from MSS

(multispectral sanning system). 1(hiS is because the images can be stored on a photo sensitive surface within each camera and this can be transfered into electronic signal which is easily stored.

Over the years improvement on the spatial resolution and spectral sensitivity of R.B.V. has been achieved. In addition, the transmission of data to the receiving station has significantly been improved with the introduction of analog and digital computers. These devices allow acquisition, transmission, interpretatiion and distribution of remote sensing data.

The acquisition, transmission, processing, distribution and interpretation of remotely sensed data have gone to a fairly advanced stage.Many experiments introduced more shophisticated sensors and computerised system for land use programme e.g. (MARRYLAND GEOGRAPHIC INFORMATION SYSTEM)

One of the latest development in the satellite remote sensing is the improvement in the resolution (both spectral and spatial resolution) potential of earth observation sensors on board of satellites.

SPOT1l Satellite Probatoire d"Obser-va.tion de La TerreJ was launched in 1986 and was to run for 8 years with an improved spatial resolution of 20m in the visible and near infrared of the XS (multispectral) while 10 mm n the panchromatic.

Sea sat launched in June 1978 has a spatial resolution of 25mm in the L band. SPOT 2 and 3 were respectively launched in 1990 and 1993. Other satellites with sophisticated sensors are space shuttle of U.S.A. launched in Nov. 1981, space imaging Radar (SIR-

A) having spatial resolutionn of 40m and SIR-B lanuched in October 19H4 havin 30m resolution.

All these in conjunction with some more recent experiments brought about a wider application of earth viewing remote sensing satellites to many disciplines.

2.7 A lication ~Of Satellite Remote sensing to Urban Problems

The vogue in Remote sensing is the acquisition of earth resources information from sensors placed on space platforms. United Nations (1973) described space Remote seYnsing as **a** ;;Methdology to assit in characterising the naturaL' features and phenomena and the environmennt of the earth by means of observations and measurement from space platforms. Specifically at present, such methods depend on the emission and reflectionn of electromagnetic r-adiat.Lorr'",

Space remote sensing has taken over most of all the remote sensing application owing to its advantages over other platforms of remote sensing. Such advantages can be summed up as:-

Improved data coverage:- space sensors allow global data collection and also the inaccessble area. An exhaustive coverage of the earth surface is made possible.

Rep titive ability :- Satellite remote sensing has greatly improved the frequency of data collection.

Spatial continuity: The data collected over the earth surface in a spatially continuous manners is made easy.

Homogeneous data: Due to data collection through one sensor,

it allows spatially consistent data to be collected.

The time of acquisition, processing and distribution is significantly reduced.

It is possible to use satellite remote sensing for a spatial extension of ground measurement (conventional methods)

Satellite remote sensing has been variously used in solving some urban problems. The use of satellite remote sensing for urban area application has been made possible due to the striking visible characteristics of urban areas. For instance, on Landsat Tm data, the internal structure of cities can be detected though they may not present a consistent spectral response and sometimes they may be difficult to discern.

In some cases the visible reflectance of urban surface types are scattered along the plane of bare soils and may be confused with a variety of other surfaces.

Land sat images have been variously used to monitor the growth in both urban and rural areas, as well as urban mapping. Jensen 19H3) reported that the U.S. Bureau of the census used Landsat data for U.S standard metropolitan satistical areas(SMSAS) Where five cities were selected and examined as a test case. After comparison with large scale aerial photography, it was discovered that the outer edges of the cities were identifiable in the images. Large individual structures such as shopping centres could not be identified on the Landsat Images.

The U.K.Department of the Environment used Landsat data to assist with the montoring of urban growth .Five towns were also

considered viz:Reading,Northampton,Preston,Hemel, Hempstead and Newmarket. The aerial photographs of scale 1:00,000 were used for ground truth. The result showed that urban areas were correctly classified with an accuracy in the range of 70-80 percent.

2.8 SPOT Satellites Application.

A significant new entry in the field of space-borne remote sensing was recorded on the 22nd Febuary 1980, When CNES Launched SPOT L] Satellite Probatoire d;;Observationde La TerreJ at 1.44 am. This is the first of SPOT satellite series . It was launched to make new data available world wide as regard the earth resources. It was jointly sponsored by sweden and Belgium govenment. SPOT was meant to operate for 2 years; but it out-lived its lifespan. In January 1990 SPOT 2 was launched while SPOT 3 was launched in September 1993. They operate simultaneously in space and posses several advantages over landsat and other previously launched earth resources.

SPOT 1 plat form was designed and used as a support system for different types of low orbit earth looking missions. This plat form is used to support other satellites such as the European Space Agency (ERSI) Raday system on Military Heliosystem.

Line scanning is carried out by linear array C.C.D (Charged coupled devices) detectors, enhancing the light collection efficiency while eliminating the need for delicate mechanical scanning. The SPOT pay-load carries two pointable - telescopes on-board, tape recorders and a dedicated data telemetry system (X-band) for transmission to the ground. Each telegscope covers a

50km swath at vertical (nadir) viewing and they can be pointed up to 500km away from the satellite track, thus enhancing accessibility to desired target areas and opening the way to a stereo capability.

The standard data "cut" for lower level data products is a 50 x 50 km aoerię The satellite was launched in a sun-synchronus orbit at a circular H32km altitude, phased 2 days cycle. The image is taken at 10.30 am man local solar time around the year as the satellite moves in herlio-synchronus orbit.

The data-imaged can be down-linked to subscribing ground receiving stations over a circular, 4,000km. diameter range. World wide data can also be transmitted through the on-board tape recorders to two primary receiving stations near Toulouse in France and kiruna in Sweden. Imagery is collected at a ground reoslution of 20 meters in three spectral bands and 10 meters in one panchromatic (black and white band).

These characteristics of SPOT give it an edge over other earth viewing satellites such as Landsat, sea sat etc Its application therefore varied.

Weil (1994) put forward an analysis of SPOT image data application globally which can be outlined as follows on the basis of the disciplines

Table 2: Table showing SPOT Data Global patronage.

Disciplines	Percentage
The mapping community	34%
Vegetation, forestry and agriculture	25%

Geology and non-renewable resources	IH%
Civil engineering and public work	H%
Urban planning	4%
General public works	4%
Coastal studies	3%

Adapted from Weil 1994.

The low patronage of SPOT data by urban planners can be attributed to the dearth of expert in this field to use remote sensing data, but most importantly urban planning data are of immense spatial integrity which require high ground resolution.

The best of SPOT (so far) has ground resolution of 10m which reduces the useability of such data for planning purposes. Utilities such as pipelines, sewage channels, etc cannot be properly detected by the sensors.

It must be noted, however that there are lots of iprovement with the introduction of VHRRBV Lvery High Resolution Return Bean vidiconJ loaded with the pay load of SPOT4 with ground resolution of 5m in the mutispectral and 10 meter in the panchomatic may be achieved. The data obtained from these sensors are expected to improve the useability of SPOT for urban planning purposes.

Increase spectral and temporal resolution of SPOT improve its relevance in urban planning. Up till date Data obtained from SPOT was used in monitoring the Natural renewable resources of sahel. The aim was to produce information to assist the national authorities in making significant decisions as regard estimation of agricuLtural production, study of the evolution of the agricultural

campaign yield forecasting.

SPOT data, Aerialphotos, ground observation were combined to arrive at the prescrl·b$_e$db· o Jec^t $_r$ves ~ The result was a classification of Sudan to three zones on the basis of agricultural potentials viz:

(a) Non-cultivated Agricultural areas

(b) cultivated agricultural area

(c) non Agricultural area.

SPOT data was also used in the land use catography of Lake Chad. Data acquired during the dry season were used because of restrictions due to the rainy season. Cloud cover, ground moisture which hide the spectral response of sattelite sensors. This project led a preparation of a cartographic map of the lake and its environments.

Another area of application is the use of SPOT Multispectral images in the Land use mapping. In a project carried out on behalf of World Bank and the Philippine Department of Enviornment and Natural Resources. SPOT Multispectral images acquired on a scale of 1:100,000 during a 12 month period, from april *19B7* to April *19BB* were used to Map the natural condition of the entire country of the Philipines. The project involved the use of 200 multispectral SPOT colour scenes and satellite image maps for visual interpretation were produced. It was discovered that this approach cost less than half the cost of using aerial photography for the same assignment.

SPOT images were also used in the study of rapid geographic

changes such as Malawi study of changes which occured during the past twenty years in the biomass content. They were used in the study of regular occurrence of flood in Bangladesh and the use of SPOT satellite data in Nigerian 1991 census is also note worthy.

SPOT satellite data can be obtained from any of the receiving stations with subscription from the intending nation.A spot satell ite station can be installed to colelct data in 4,000 km range of the satell ite over pass. The countries where SPOT satellite receiving station are currently installed are Touhouse in France and Kurna in Sweden where the whole world data are down linked other receiving stations include prince Alber, Contpaxi, Culaba, Hartebeeshock, Maspalomas Gatineaa, Tel-Aviv, Riyadh, Islama bad, Cung Li Hatoyani, Parepare, Alice Spring (Weil 1994).

The use of SPOT for urban planning has been highlighted previosuly. It is noteworthy that the ability of SPOT satellites to provide urban data to the nearest ten days or less allows for the estimation of urban growth.

CHAPTER 3

METHODOLOGY

As identified earlier Master plan consist of socio- economic, physical, cultural and politcal elements. However for the purpose of this study the physical elements were considered. It is noteworthy that all other elements of Masters Plan hinge on the physical elements as every aspect of the city has physical connotation.

The physical elemenets of the mastter plans can be divided into 3 aspect (Onokerhoraye and Omuta 1980) which are Land use, circulation, communities facilites, civic design and utilities. The physical aspect of Abuja was observed on the basis of four parameters viz:

a. Civil design/general concept of the city

b. Land use and land cover layout

c. Circulation

d. Community facilities/utilities.

a. Civic Design:

The overall form (pattern) of the city was derived from detailed study of other Newtowns of the world and their planning experience.

The partern adopted for FCC was at the instance of looking into these parameters.

Township image: which reflects the status of the city and the purpose to the observers. The city was treated with unique visual quality with due emphasis on harmoneous relationship of key features of the site, both natural and man made. The design of the seat of government with respect to its visual prominence and differentiation from surrounding structures can also be observed.

ii. efficiency: In order to achieve this, commercial centres were combined, Repettiion of identifiable units was also integrated to enhance efficiency of construction, repeated planning and construction modules.

iii. Flexibility: The plan also provides for orderly urban growth over an extended period of time. Loose-fit approach to planning was adopted in the FCC master plan in order to retain the desired flexibility.

b. Land Use/Communites facilites

The Land use requirements were based on the employment and poulation break downs developed in the programming process.

The central area has major land uses as communities facilities such as seat of government, Central Business District/Commercial core, National Cultural Institution Zone, National Sports complex, Transportation center, Foreign Embassy Area, Central Area parks and squares. It has High Density Residential Community integrated there also. Map 4 shows the Land use plan of the F.C.C.

c. Circulation

There are two categories of transportation system in F.C.C. These are: Those that provide for intra-city movement, and those that provide for intercity and interregional transportation need of the city.

Three categories of land uses for transportation can be observed in the study area: Road network, Rail link, Airport.

Road Network:- The road network in FCC has a dominant backbone of Two transit spines that form the central backbone of the city. They enter the central Area and serve it in four parallel streets. Other road network crosses the spines forming series of cross-junctions. The general concept of road network design is linear in approach.

Rail system: The feasibility studies of the economic justification of rail system in Abuja proved the location as an unwise venture. Nevertheless three rail routes were proposed. However none of the proposed routes fall within the study area therefore it is dropped from being used as a comparative parameters.

Air port

The air port is located outside the study area thus it is ignored in the process of analysis.

Due to the characteristics of space-borne sensors having a relatively low ground resolution detailed interpretation of the satellite imagery was restricted to only three parameters which are Land use, (in its general perspective) circulation, and civic design.

Data Requirement

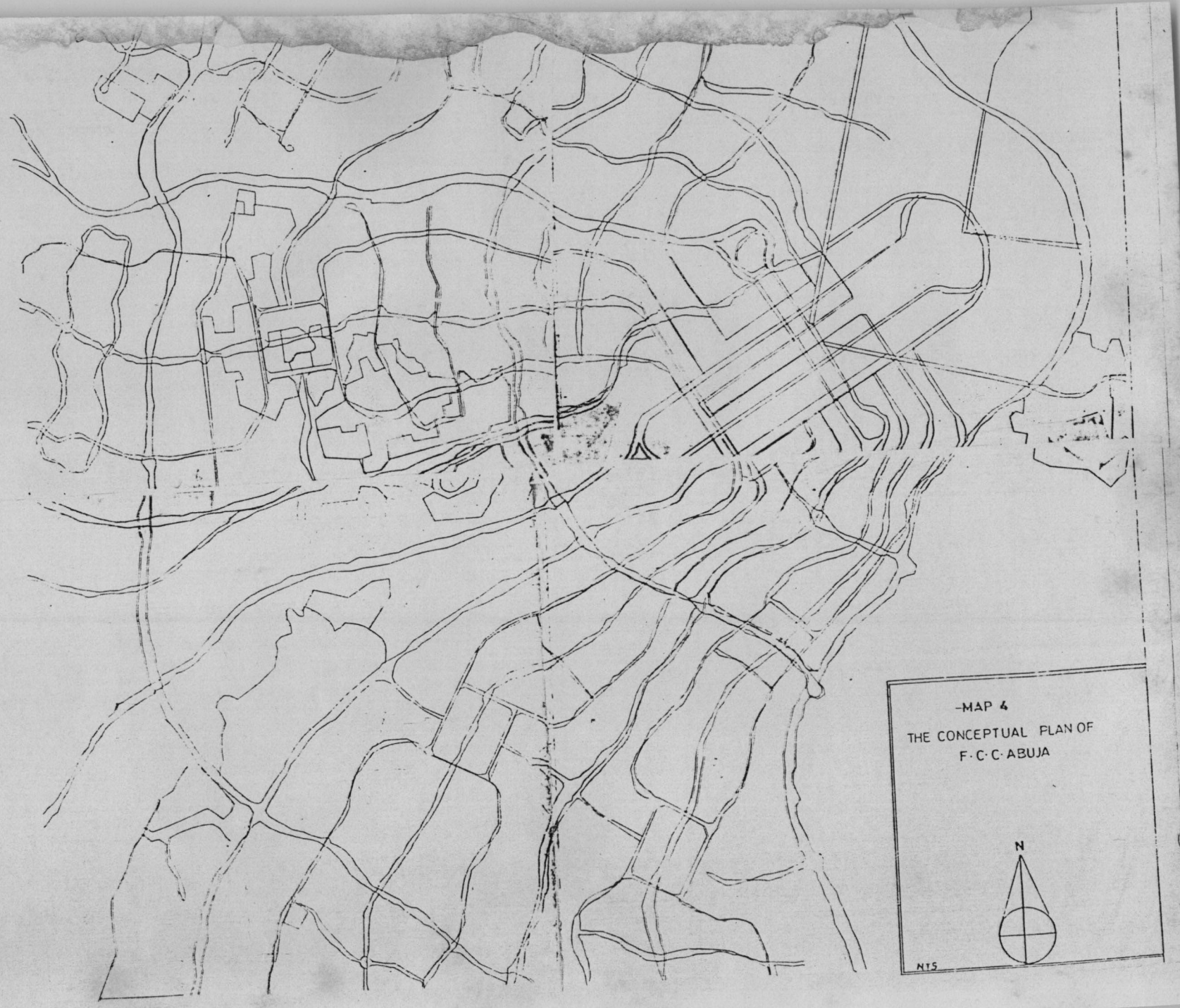
As earlier mentioned the choice of Federal capital city (Abuja) for this study is a matter of convenience and ready source of data. The dearth of satellite Remote sensing data in developing country like Nigeria and the exhorbitant price of those avialable limited the scope of this research.

A black and white panchromatic SPOT scence covering theF.C.C. Abuja on the scale 1:50,000 was obtained. This was enlarged to the scale of 1:~5,000. for easy interpretation. The scene has a ground resolution of 10m. Some buildings could be enumerated with mirror magnifier. the date of the scene was collected on October 1990.

A copy of Abuja master plan was obtained produced by the Federal capital Development Authority. The policies, concepts and the design of the city was extracted from this document.

The Layout scheme (information plan) produced by the SF consultant for the phase 1 and phase II of the F.C.C. was obtained. this gives a detailed design of the impression of designers involved in the planning.

During the period of statellite over-pass for the scenle on hand the master plan was at the middle stage of implementation i.e. October 1990. However at the time of carrying out this study the stage is in advanced stage of implementation while implementation of stage II has commenced. This call for meticulous ground truthing to update the satellite images.


-MAP 4
THE CONCEPTUAL PLAN OF
F·C·C·ABUJA
N
NTS

Procedure

The process of ana1YS1S for t.hiS study commenced with critical appraisal of the F.C.C. Abuja master plan. This allowed a critical appreciation of the content of the master plan. The conceptual plan of the master plan was digitised and adjusted for reduction for necessary comparison. However, it was discovered that the conceptual plan is not congruent to the affixed scale hence it was not Possible~ascertain the scale of this map.

SUbSeqU~t to this the satellite imagery was converted to line map through visual interpretation with the aid of simple instruments as hand lens and stessossopas. Sequel to the acquistion of this data the re e-enter proceeded for the groung truthing. The major land uses were identified and established on the map. However for clearity sake the reseacher restricted the ground truthing to roads and major land marks with other relevant land uses.

The layout plan (Information plan) produced by SF consultant was obtained from the Development control unit of FCDA {Federal capital Development Authority). This was photo reduced and converted to scale 1: 25,000 to allow comparison with the other plans.

The next step was to identify area of recent implementation in the plan juding from the time of satellite data coverage.

The conceptual plan and the information plan were compared ·:isually without over-laying due to marked variation that is visually discernable. The parameters of comparison are

irculation, major land uses, civic design.

Consequently the information plan and the satellite scene ere compared by manual overlay of one on the other. The result is ell documented in the next section of this thesis.
he degree of deviation was ascertained intuitively.

It is note worthy that the ground truthing revealed that some f the deviation came as a result of natural and man-made obstacles hich were not considered properly at the comsumation stage of the lan .

.3 Limitation of Study

Finance and Determination are the necessary pivots upon which he successful completion of this project swings. The high cost of ata/especially satellite scene, is a major constraint for a esearch of this status, especially in developing countries. The atest scene that could be obtained by the researcher was sensed in 990. Therefore the time gap between the satellite over pass and he period of the project is fairly considerable for effective omparison.

There are some other problems that were encountered in the ourse of the study and are succinctly highlighted below:-

The conceptual masterplan obtained has ambiguous scale.

the linear scale at the bottom does not correspond with

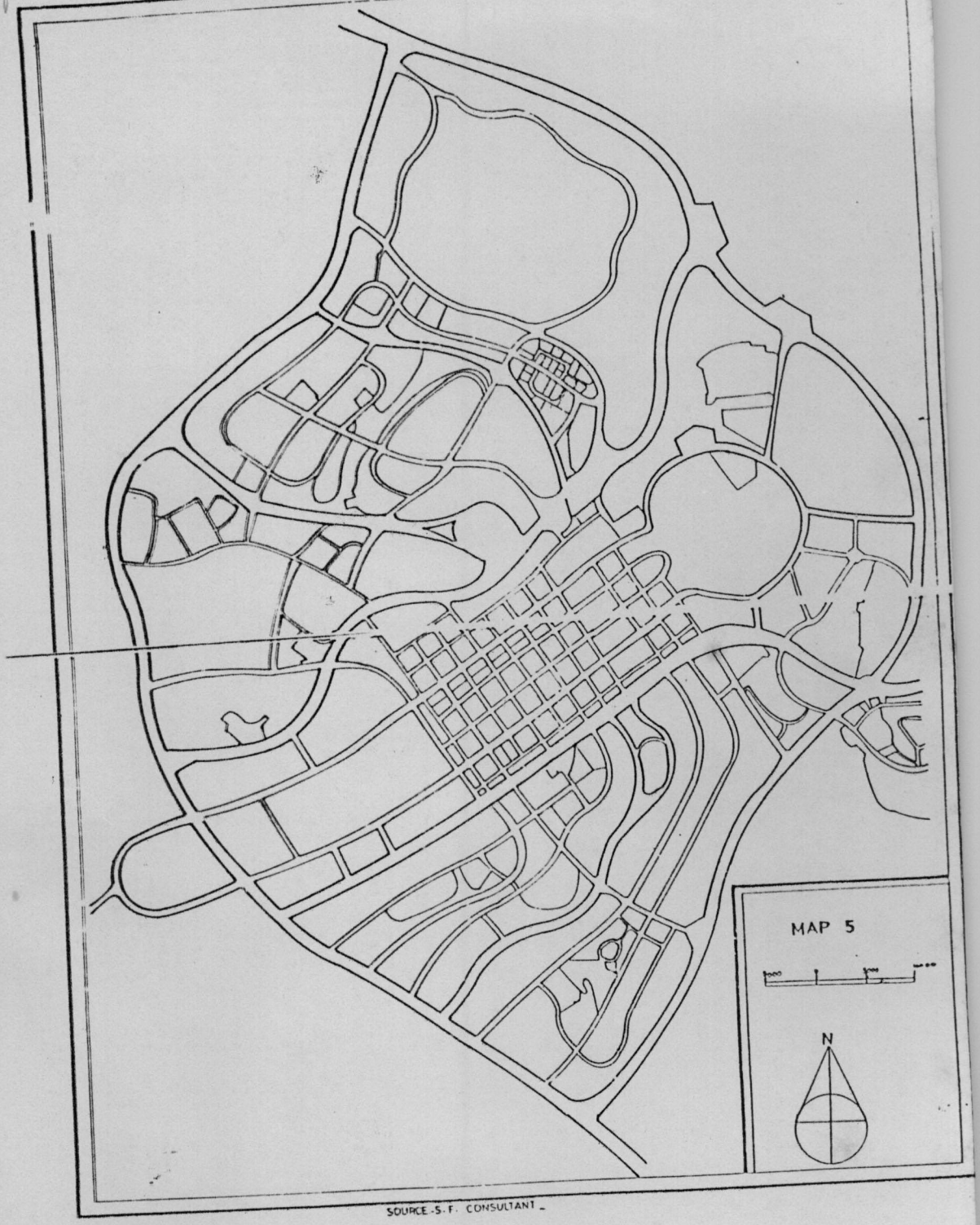
the actual scale of which the plan was drawn.

The conceptual plan also lacked any proper co-ordinate system. .t was thus assumed as a mere concept of the final plan.

There was no facility to carry out digital analysis of the imagery hence manaal .verlay and visual image proccessing was adopted.

In any case the exercise was very intresting.

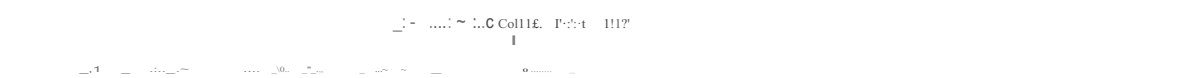
LAND USE PROPOSAL PLAN FOR FEDERAL CAPITAL CITY ABUJA. ADAPTED FROM COMPREHENSIVE INFORMATION PLAN OF F.C.C.



SOURCE-S.F. CONSULTANT.

No Caption

FEDERAL CAPITAL CITY ABUJA \.



CHAPTER 4

4.0 ANALYSIS AND DISCUSSION

The three para.eters of: comparison were held constant throughout the analysis process and served as the basis of estimating the level or deviation.

The esti.ates were done in three levels.

LEVEL 1

4.1 Comparison or Conceptual plan with layout plan Llnformation plan)

The coceptual plan as shown in Hap 4 reveal that the plan was just a sche.atic design withput serious referencing to the geomorphology and other nalural features on the ground. This accounted ror the gross deviation from the conceptual plan and informatin plan. Shown in Map ,5.

1t was observed thal the loop at the central spine was grossly extended in the information plan. The general pattern of the city is riotseriously affected.

Apart rro. the general conceptual pattern, the information plan

is not in any serious way consistent with the master plan conceptual proposal. It was noted that the Neighbourhood/District wholistic design approach adopted in the proposal was not followed or at best was significantly modified in the information plan.

It is quick to deduce that the conceptual proposal plan gives little or no credence to the landscape quality and characteristic of individual site.

The major deviation is in the circulation. It manifested by the introduction of some roads, and the removal or adjustment of several others. It is noteworthy that the manupulation of ~ changes in road network resulted into changes in other landuses in terms of location, sizes and prominence.

LEVEL II

4.2 Comparison of information plan with the satellite scene.

The satellite scene was obtained during the month of October 1990. Phase I of the master plan was in advanced stage of implementation while the phase II;s implementation has begun in earnest. Some of the roads were still untarred as at this period but the reflectance properties of graded road allows the roads to be spectrally discerned. The scale of the plan 1:25,000 also allows the observation and enumeration of buildings.

The buildings in each neighbourhood were counted visually (subject to human erros). The total number of these buildings were estimated in the ground truth exercise and the result was dipicted in the next section.

For easy estimates, the deviation were categorised into three

types which are: 1. Deviation by displacment: this refers to all deviations in the implementation that were not positionally accurate compared with what was proposed in the information plan. 2. Deviation by substitution: this refers to deviation caused by replacing the proposed use with another land use altogether. 3. Deviation by omission: this covers all the deviation that were originally in the information plan (proposal) but were not detected by the satellite, this types of deviation ranges from land uses that are yet to be implemented to those that have been dropped from implementation, to those that are too difficult to be deteected by the visual interpretation of the SPOT satellite scene.

Armed with these three methods of categorisation the research proceded to assess the implementation of the landuse, circulation and the civic design.

4.2.1 Deviation by Om ission.

Circulation.

About 40 percent of the circulation network falls in this category. The two inner express way; both the inner southern and inner northern express way were yet to be implemented, the ground truth also reflected that as at 1995 March these two roads are yet to be constructed.

The transist ways are also not yet implemented. These are outer Northern transist way, on the left side of the Northern express way, the inner southern transist way on the right side of the inner southern express way.

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The parkways are also involved in these categories.The collector roads are not left out in this category of deviation as are properly shown on map 7.

The roads ommitted can be found in the ministries Zones, cultural zones, Wuse District, Garki district and Maitama district.

Some arterial roads are also left unimplemented, such as Arterial 314, Arterial 51, Arterial NIl, Arterial N14.

Civil design.

On a general analysis, the beauty of the Federal Capital city is nothing compared with the proposed aesthetic content of the plan. The gross deviation in the circulation has inevitably affected the overall internal organisation of the city hence its pattern.

From a visual coparison of Map 5 (the information plan and Map 0 (the satellite scene) the difference in the general pattern is easily discerniable. It is estimated that aesthetically about 30 percent of the aesthetic component of the city were dropped from implementation or yet to be implemented. The buffer zones along the arterial, ring roads, Transist road and expressways were not implemented fully.

Land use/band cover

This type of assessment was a little difficult due to the following reasons:

a. Most of the land uses that were not implemented have been replaced by other land uses, thus they cannot be

categorised as deviation by omission.

b. Some land cover are not detectable from the space due to limited capabilities of the sensors on board in terms of ground resolution.

c. Some authors categorised circulation as part of land use hence the omission identified above can also be regarded as deviation in the land use implementation.

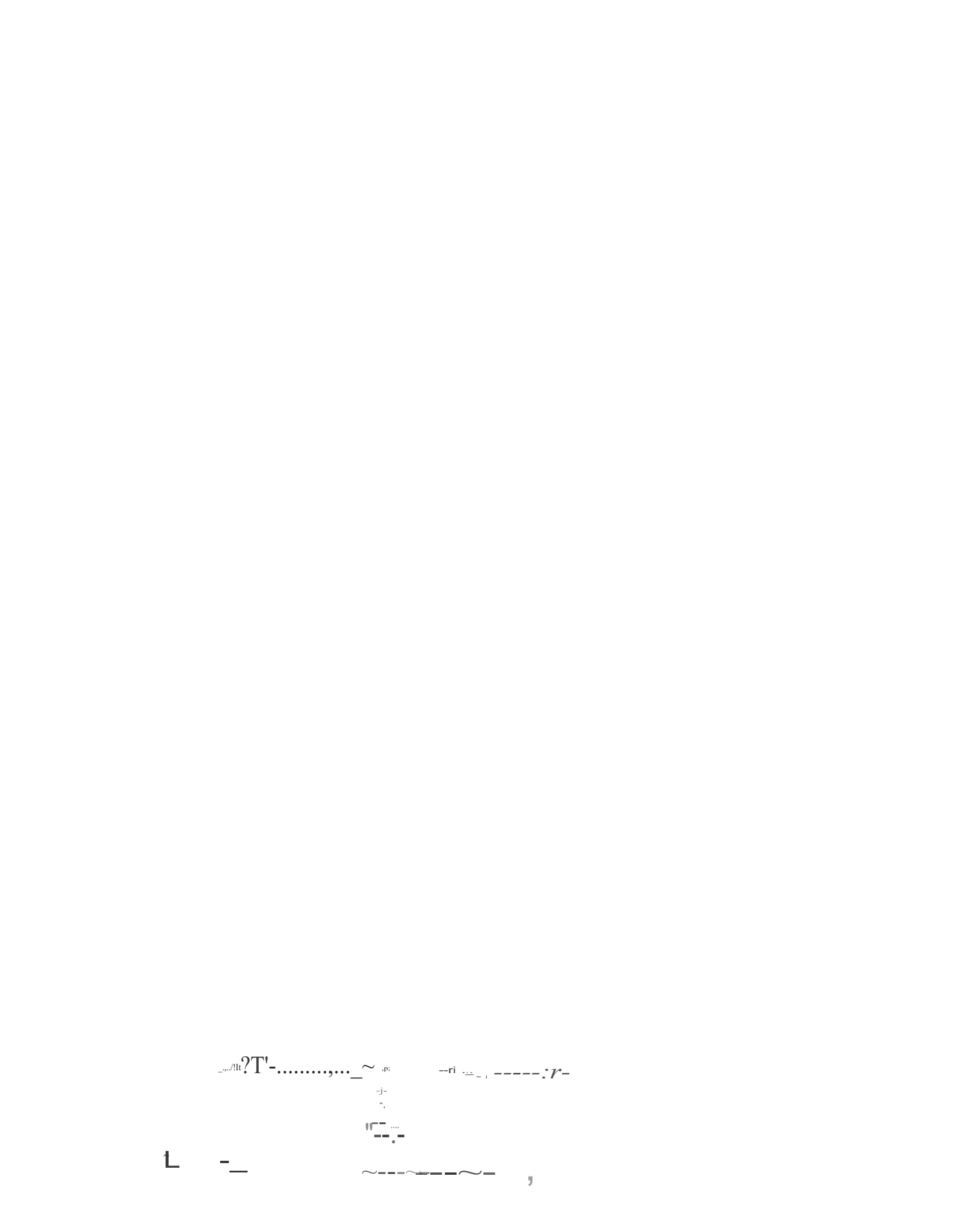
4.1. a, Deviation by substitution:

This category of deviation are very ubiquitous outside the ring road when new layout of residential plots can be detected. As shown in the map 7, it can be found in the left side of the outer Northern express way and the southern part of the city close to the Namdi Azikiwe road (ring road) the residential layout in this section is completely rearranged contrary to the original layout proposal. This set up can also be found as pockets of deviation in vairous parts of the city.

Deviation by substitution are the lowest in the overall deviation discernable from the satellite scene in this category of deviation identified during the ground truth. These are reflected in the next section under the ground truth. This type of deviation covers about 15% of the total site.

4.~.3 Deviation by Displacement

This type of displacement is discernable in about 35% of the implementation.



As shown in Map 7 some roads e.g. the three arms zones, the Ministries Zones, the National Art theatre Zone the Northern outer expressway the central arterial loop among others show certain degree of deviation by displacement.

The displacement ranges from a little extension to complete displacement from the original position. It is likely that this displacement is a resultant effect of some natural features that must be taken into consideration during the specific site planning and engineering design.

It is noteworthy that this deviation by displacement affected the morphology of the city in a major way especially the cityscape was changed from what is on the plan.

The place occupied by the National art theatre is far smaller than the proposed space, while the location of some precinct were changed.

4.3 Ground truth

The ground truth exercise was limited to those features covered by the satellite scene. No attempt was made for extensive update of the plan except in some minor cases.

Map B shows the result of ground truth. Some level of deviation can be identified. Jrhe portion presently utilized for Wuse market was orignally proposed for a secondary school. Roads bear names different from the names attached to them in the proposal.

The areas that rec"eved full implementation in terms of land

uses are Three arms Zones, the ministries Zone, the central Bussiness area, the Azokoro District and Maitama district.

Areas with high degree of deviation can be identified. These are Wuse district, and Garki district. The North eastern part of Maitama district also experienced some element of deviation in terms of land uses. For instance, the Nicon Nuga Hilton Hotel located here seem to be out of tune with the town scape adopted in the area.

As at the time the satellite scene was obtained few buildings were in place in all the districts.

Wuze district has about 1,070 units of buildings on the site as at October 1990.

Maitama district, 379 units could be discerned. Within the Three Arm Zone about 1~7 buildings were identified.

Garki distirct had a total of aobut 954 units Azokoro district had about 4~1 buildings as at October 1990.

These figures are subject to distortions as a result of limited abiity of visual interpretation.

It is also note worthy that the type of uses that those units were put could not be deduced. This is due to uniform spectral responses that the building roofs posses. It is possible that some make shifts and other temporary structures, such as site offices will be enumerated during the exercise.

However the ground truth revealed high degree of accuracy in the satellite scenes. The flexible approach used in the design of the master plans also caused high degree of deviation because some

of the layout pattern within the district could equally acccommodate office complexes as well as residential units.

The approach resulted to integration of both residential units and commercial, Administrative and light industrial uses within districts or zones. While this approach has some advantages such as increasing the period of active uses in each sector of the city where there will be no "ghost town"), it however had grave future consequences. The city scape as well as functionality of the capital will be progressively affected adversely. This is evident through the ugly sight that characterised the residential components of the city centres.

Residential precincts are noted to degenerate faster than other land uses in terms of beauty, structure and maintenance. The fact that they are owned by individuals complicate the problems as it becomes difficult to effect general renovations.

CHAPTER 5

SUMMARY OF FINDINGS

The study reveals massive deviation in the implementation of the Federal capital city -Abuja master plans. These deviations were grouped into three, which are Deviation by displa~ent, Deviation by omission and Deviation by substitution.

It was gathered from the study that deviation by omission covered the highest percentage. This can be attributed to the fact that the implementation was still going on as at the time that the SPOT image was obtained. However it was identified that some roads were not implementated, sum as arterial roads, transist spines, collector roads etc.

The second in ranks of deviation is the deviation by substitution which is more in terms of specific land use substitution than a general substitution. Some small land uses that fall into this category cannot be identified from space due to the limited satellite sensors ground resolution.

The third in rank is the deviation by displacement where land uses were observed to have been shifted a little or greatly from the original position earmarked for them in the proposal. This category of deviation was observed more on the road layout.

A visit to the Aim Consultant, company involved in the construction of roads revealed that aerial photographs rather than the proposal served as the basis for their design. Reference were only made to the master plan to know original destination and

transit zones.

The possibilities of using satellites images to assess the level of implementation in Abuja master plan was proven. It is thus possible to track the development on timely basis using this devices. Fabiyi (1995) ascertained that satellites data can be utilized for monitoring development in Nigerian cities.

There are no strict guidance from the F.C.D.A. to ensure total compliance with the original proposal. Therefore subsequent consultants resorted to easy way approach to design.

Political influence in the implementation was enourmous and resulted in many deviations. The elastic nature of the master plan aplso gave room for deviation. It is unfortunate that this weakness of the plan was overplayed to the detriment of the overall functionality of the city and the beauty of the city scape.

The natural features and lanscape obstacles were not properly considered in the layout design. The survey was either inaccurate or not competently interpreted before the initial proposal.

The causes of deviation are noted below:

1. Natural and man made features: It was noted that some of these features were not properly referenced during the conceptual plan preparation . The layout plan was based on the survey work, where the actual position of the features were shown.
2. Cost constraints: The engineering design for road networks were contracted out, the contractors placed more emphasis on cost implication of the road constructions Therefore the course of roads changes.

3. Political decision and influences: Abuja being the capital city of the nation , has been subjected to various changes due to change of leadership at both national and FCDA levels .

4. Inadequate equipment and data to monitor the level of deviation and to test the likely future consequences of deviations . These encourage contraventions of private land uses.

5. Inactivity of Development control officials in educating the consultants on the need to strictly follow the master plan proposals during detailed engineering designs .

0. Logistic problems which range from lack of vehicles to adequate competent staff to properly monitor the growth development throughout the federal capital city.

Recommendation

In view of the salient facts rev~ed in the last section there is need to employ a multidisciplinary approach to master plan preparation right from the onset. This will guide against extensive deviation.

Nigeria being peculiar in terms of contravention it should be encouraged that master plans be made rigid rather than being flexible. The implementing agency may not be able to properly present the idea of the planners involved in the preparation of plans.

More shophisticated approach of monitoring the developments should be adopted for our cities. As cited in Fabiyi (1995) An attempt should be made to establish satellite receiving stations (preferably SPOT or some more powerful satellites).

It is time for Nigeria to computerise her development control system so as to properly track the development as well as provide a laboratory atmosphere for the consequences of deviations.

Computerising plan monitoring will ensure compliance and make development control very cheap to undertake by the government.

This approach can be done in three categories as highlighted

by Fabiyi (1995). It is recommended that the country involve herself in space experiemnt. As temporary measure the proposal for introducing satellite data to urban and rural admnistration is thus grouped into three basic classes

a. The satellite Tracking ground station

b. The information transmission

c. The Local government development monitoring units.

(a) Satellite Tracking ground station.

The effectiveness of satellite remote sensing in producing real time, up-to-date data of earth resources endear it to the heart of many expert of earth related disciplines.

As stated earlier in this paper, SPOT has 16 receiving stations allover the world where information can be downlinked from the satellite over pass within the radius of 4,000 km to the station.

Up till date there are no receiving station close to Nigeria. In fact there are only two stations for SPOT in Africa. The installation of ground receiving station is thus recommended. This station can be installed in Federal capital city Abuja, with the hope that a complete coverage of the country being 932,000 km^{G} can be obtained.

The ground receiving station will also georefrence the data, and other image deformation can be corrected before the information is transmitted.

b) The information dissemination station

This station can be separated or combined with the above

b) The information dissemination station

This station can be separated or combined with the above station. It will be charged with the responsibility of processing of digital images and convert the data to use specific mode before desseminating the data to the corresponding agency(ies).

It is expected that all the parastatals that deal with land and natural resources will have representatives in the station in order to adapt the processing of data for their specific uses.

The information obtained can be transmitted to Land and survey, Ministry of works, and Housing, Urban development boards, state town planning authorities, Ministry of aviation and Transport, media department etc.

Each Ministry and parastatals is expected to have micocomputers installed in their offices loaded with appropriate softwares for project specific analysis of the sites in their jurisdiction.

c) Development Control Units

In Nigeira, states have ministries of town planning which are saddled with responsibilities of monitoring and controlling developments within their jurisdiction among others. In a few states a special board christened urban development board is changed with responsibilities of town planning.

It is recommended that computer hardwares be installed in the state ministries of town planning or urban development boards where the computer compacti ble tapes (CCT) sourced from the national

information dissemination centre can be processed into masaic form, for onward transfer to each local planning offices.

Two levels of control will be effected on development with the use of this approach. The first tier of control will be at the state level where land use planning will take place for the individual local planning authorities. Each development control unit in both state and local levels will receive satellite data from the information dissermination station or state ministry of town planning as the case may be either inform of computer compactibel tape or hard copy image maps.

CONCLUSION

The study succeeded in examining the tremendous capability of satelli te data in monitoring the process of development in the Federal Capital city Abuja. The degree of deviation was assessed and proposal for ameliorating the problems of deviation was porposed.

Efforts were made to propound a proposal of reform in the prevailing approach to development control. The integration of satelli te remote sensing into urban management in Nigeria was succinctly addressed.

It is hoped that further research on the introduction of image processing and Geographic information system into Nigeria urban planning and management system will take a leap from the results of this study.

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