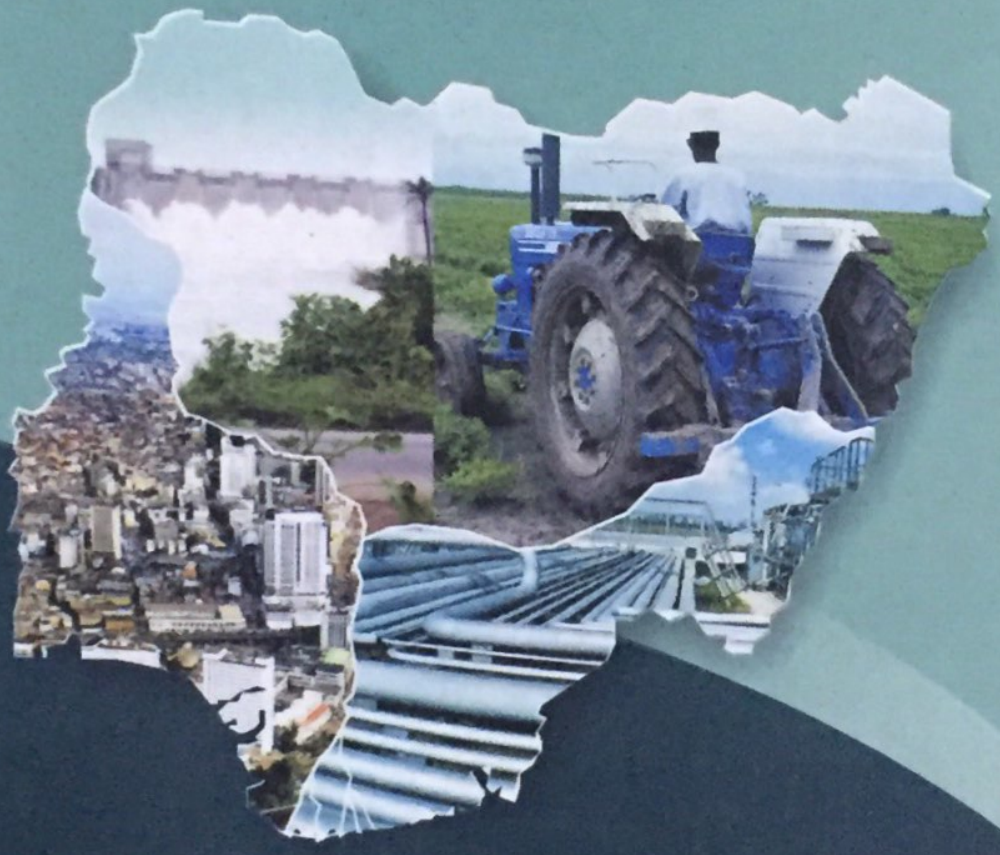
Regional Planning and Development in Nigeria



Edited by:
Bolanle Wahab
Layi Egunjobi
Timothy Gyuse
Waheed Kadiri

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2010 MCPDP Technical Committee Members:

Timothy Gyuse
Nathaniel Atebije
Kola Sanni
Toyin Ayinde
Nasiru M. Shehu
Ibrahim M. Yunusa

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8

Analysis of Regional Planning Information

A. M. Jinadu and O. O. Morenikeji

8.1 Introduction

Urban and regional planning is a specialized form of professional activity which is defined as the art and science of spatial ordering of land uses at all levels (national, regional and local) for the purpose of creating a functional, efficient, aesthetically pleasing and sustainable environment for living, working and recreation. The planning profession is devoted to human welfare and the main concern of urban and regional planning is to improve the welfare of individuals and communities by creating more convenient, equitable, healthful and attractive places of abode for the present and future generations of mankind.

Regional planning is an aspect of the general urban and regional planning activity which is focused on a group of towns and cities that

constitute a region. According to *Wikipedia Encyclopaedia* (2013), regional planning deals with the efficient placement of land-use activities, infrastructure, and settlement growth across a larger area of land than an individual city or town. It is, therefore, the planning and distribution of activities and social benefits at the sub-national level so as to meet the development objectives of people in a region. The overall goal of regional development planning is to address the problem of natural resource distribution by providing access to land and social infrastructure so as to reduce social, economic and political inequalities across the supra-urban or sub-national space. The scope of regional planning is wide, covering all aspects of social, economic and physical forms of planning within a region.

Regional planning is data or information-intensive. Therefore, effective regional planning requires large quantity of information collected from a wide range of sources. According to Onokerhoraye and Omuta (1986), planning is future-oriented and the degree with which the future can be handled will depend on the quantity and quality of the information available and how the information could be used to anticipate the future. Thus, the success of regional planning and the quality of regional planning output in any nation will depend on the availability of adequate spatial and temporal data as well as proper processing of available data to achieve the desired results.

There is no doubt that the collection and proper analysis of planning information are central to effective and sustainable regional planning in Nigeria. However, many regional development planners in Nigeria and other developing nations of the world face huge challenges in the area of information collection and analysis. In this chapter, the basic issues of types of planning information; sources and methods of data collection; data analytical techniques as well as the challenges of planning information collection and analysis are addressed.

8.2 What is Planning Information?

The understanding of what constitutes planning information could begin from the clarification of the similarities and differences between the words: *data* and *information*. The word data is variously defined in the literature. According to *Wikipedia Encyclopaedia* (2014), data is a set of values of qualitative or quantitative variables. It is referred to as some form of information in raw or unorganized form (such as alphabets, numbers, or symbols) that refers to, or represents conditions, ideas or objects (*Business Dictionary.com,* 2014). On the other hand, information is defined as knowledge obtained from investigation, study, or instruction (*Merriam-Webster,* 2014). It is generally referred to as "knowledge communicated or received concerning a particular fact or circumstance" (*Wikipedia Encyclopaedia,* 2014).

The conceptual definitions of data and information in the literature indicate similarities and differences in the meaning of the two terms. In concrete terms, data could be described as individual pieces of information. In terms of the differences, data is raw, unorganized facts that need to be processed. It can be something simple and useless until it is organized to give it some meaning. However, when *data* is processed, organized, structured or presented in a given context so as to make it useful, it becomes *information*. Therefore, information is knowledge gained through study, communication, research and instruction i.e. factual data (*Dictionary.com,* 2014). It is evident that all data contain elements of information while information represents data in processed form. In most cases, information is used as synonyms of data and facts and the two words are often used interchangeably in the literature. For the purpose of convenience and to remove ambiguities, *data* and *information* are used interchangeably in this paper.

The word information has a universal meaning, regardless of the discipline or geographical location. Therefore, planning information

simply refers to a set of qualitative and quantitative values, variables, elements or facts that give context and meaning to a planning problem that could be further processed to yield knowledge. Adequate, up-to-date information is an essential ingredient that provides facts for planning and for solving all planning problems. The collection, organization, analysis and presentation of information are, therefore, an important aspect of all forms of physical planning.

8.3 Types of Regional Planning Information

Information for regional planning is wide and diverse and they are in different types and forms. The types of planning data could be categorized based on their sources and nature or characteristics. With respect to data type based on sources, there are primary and secondary data; while in terms of nature or characteristics, there are qualitative and quantitative data/information. These are discussed below.

i. Primary Information

This is the original data/information **collected** for specific purpose(s). Primary data are first-hand information collected by a researcher or employed field enumerators from the original source.

ii. Secondary Information

This is **collected** and documented by other researchers or organizations for another purpose. Such data becomes secondary data when accessed and reused by other people.

iii. Qualitative information

Qualitative data is a categorical measurement expressed not in terms of numbers, but rather by means of a natural language description (Wikibooks, 2014). When such data have no natural ordering of

categories they are called *nominal* variables, e.g. gender, race or religion. Qualitative data that appear in form of ordered categories are referred to as *ordinal* variables, e.g. size – small, medium and large. Generally, qualitative information is that which cannot be described through numeric numbers or values and they describe quality rather than quantities. Qualitative information could be accessed through some measurement criteria, such as high or low, good, fair or bad, etc.

iv. Quantitative information

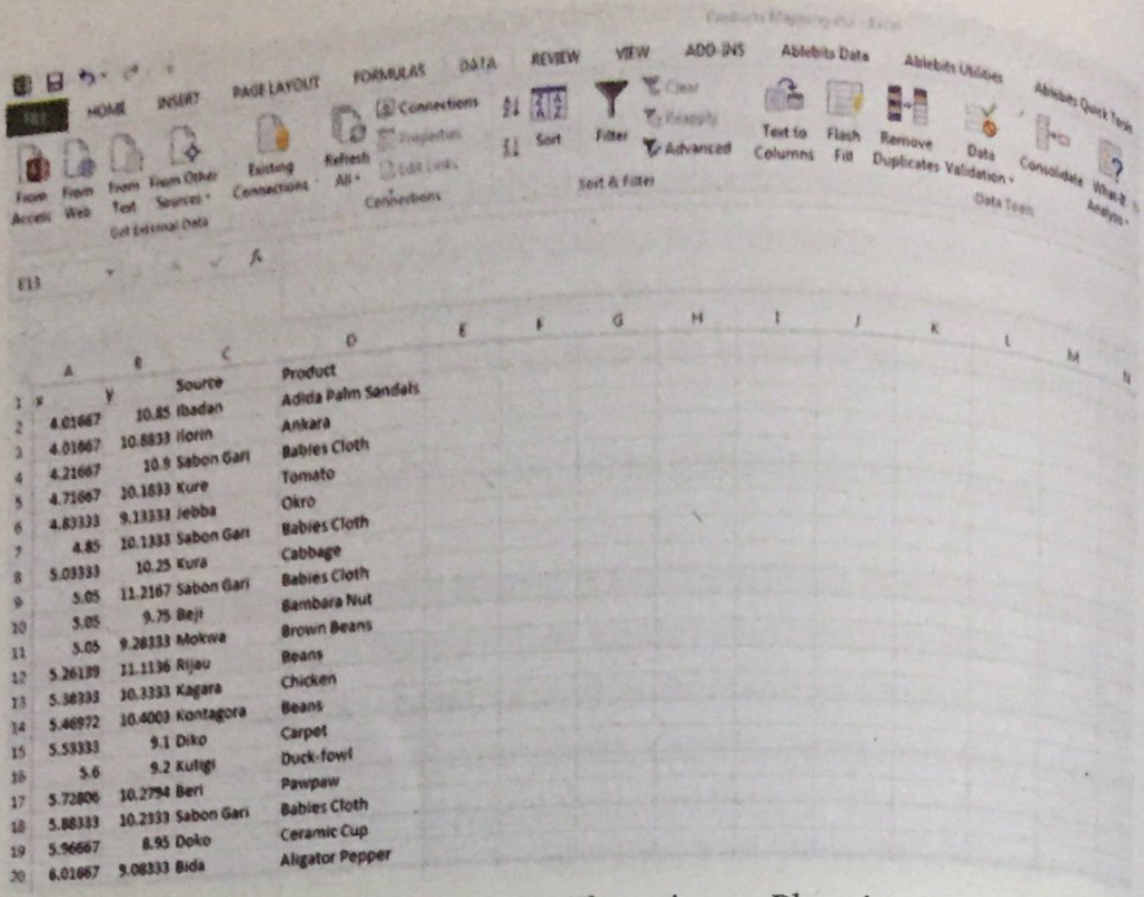
This is a numerical measurement expressed not by means of a natural language description, but rather in terms of numbers (Wikibooks, 2014). Quantitative information is associated with scale measure and the most common types of scale are the *ratio* and *interval* scales.

8.4 Forms of Planning Information

Planning information appears in different forms and formats. Such information could be presented in discrete form or as a combination of two or more information in different forms. For example, a document (e.g. map or plan) may present quantitative information, such as percentages of different land uses together with qualitative information such as location and types of uses. The different forms which planning information may take are discussed below.

i. Table or Spreadsheet

Numeric planning data, such as population figures, traffic volumes and temperature or rainfall values may appear in table or spreadsheet format. The table or spreadsheet often contains rows and columns with relationship or sometimes no relationship – describing issues with no relationship. Figure 8.1 gives an example of planning information in a spreadsheet form.

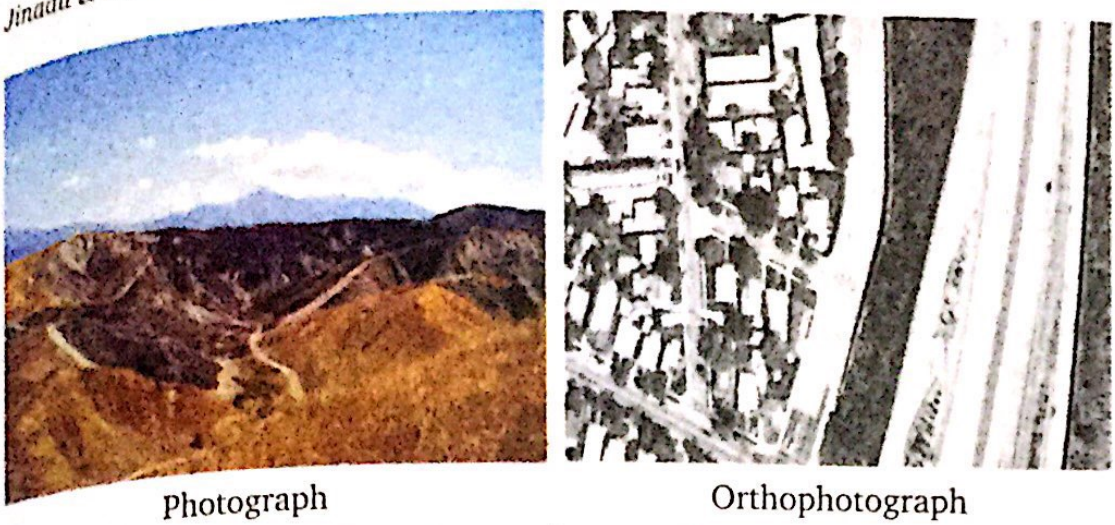


	A	B	C	D
1	x	y	Source	Product
2	4.01667		10.85 Ibadan	Adida Palm Sandals
3	4.01667		10.8833 Ilorin	Ankara
4	4.21667		10.9 Sabon Gari	Babies Cloth
5	4.71667		10.1833 Kure	Tomato
6	4.83333		9.13333 Jebba	Okro
7	4.85		10.1333 Sabon Gari	Babies Cloth
8	5.03333		10.25 Kura	Cabbage
9	5.05		11.2167 Sabon Gari	Babies Cloth
10	5.05		9.75 Beji	Bambara Nut
11	5.05		9.28333 Mokwa	Brown Beans
12	5.26139		11.1136 Rijau	Beans
13	5.38333		10.3333 Kagara	Chicken
14	5.46972		10.4003 Kontagora	Beans
15	5.53333		9.1 Diko	Carpet
16	5.6		9.2 Kuligi	Duck-fowl
17	5.72806		10.2794 Beri	Pawpaw
18	5.88333		10.2333 Sabon Gari	Babies Cloth
19	5.96667		8.95 Doko	Ceramic Cup
20	6.01667		9.08333 Bida	Aligator Pepper

Figure 8.1: Sources of Commodities Flows into a Planning Region
Source: Authors (2014)

ii. Photographs and Orthophotographs

Planning information may also take the form of photographs and orthophotographs. Photographs contain pictorial elements or data of a geographic phenomenon or entity which describes the existing condition, while an orthophotograph is a geometrically corrected aerial photograph which is an accurate representation of earth surface features, e.g. a city, and on which true distances could be measured. Photographs and orthophotographs are important forms and sources of planning information and may be used to record the elements of urban landscape or the use of urban spaces (Figure 8.2).



Photograph Orthophotograph

Figure 8.2: Planning Information in Photograph and Orthophotograph Forms

Source: Hassan (no date)

iii. *Maps and Plans*

Much regional planning information are presented in form of maps containing the political, socio-economic and environmental data of the area of interest or in form of graphic plans illustrating the distribution of land uses. Depending on the scale, maps contain vast information and they could be used to store lots of land features such as the terrain, vegetal cover, routes, recreational areas, wildlife parks, and social facilities, at the regional level (Figure 8.3).

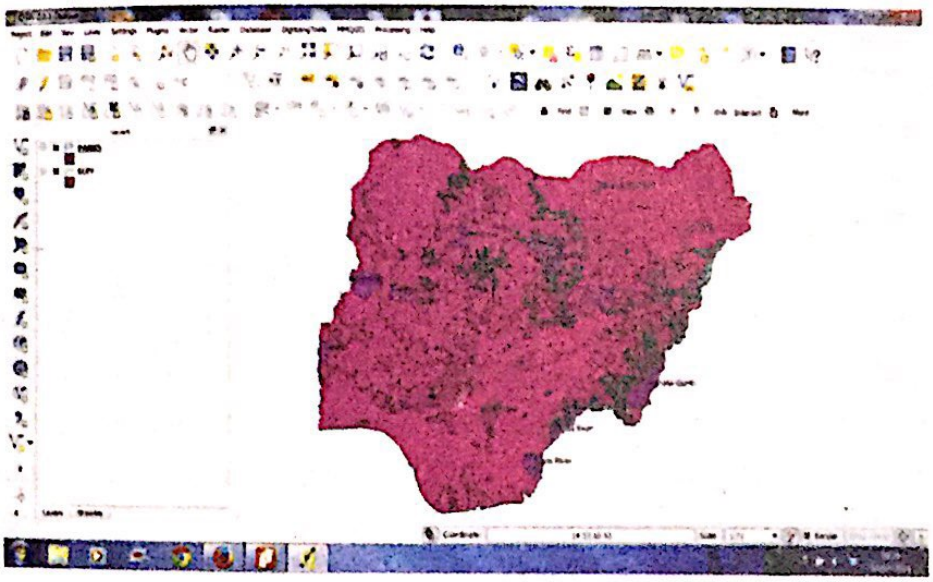


Figure 8.3: Distribution of National Parks in Nigeria

Source: Prepared by the authors using data supplied by WHO (2006)

iv. Charts

A chart is an illustration of analyzed or processed data and it is a form of planning information. Charts of different types are used to convey or store information on regional issues, like population trend, vehicular traffic flows, accident rates, movement of goods and services, and migration. See Figure 8.4.

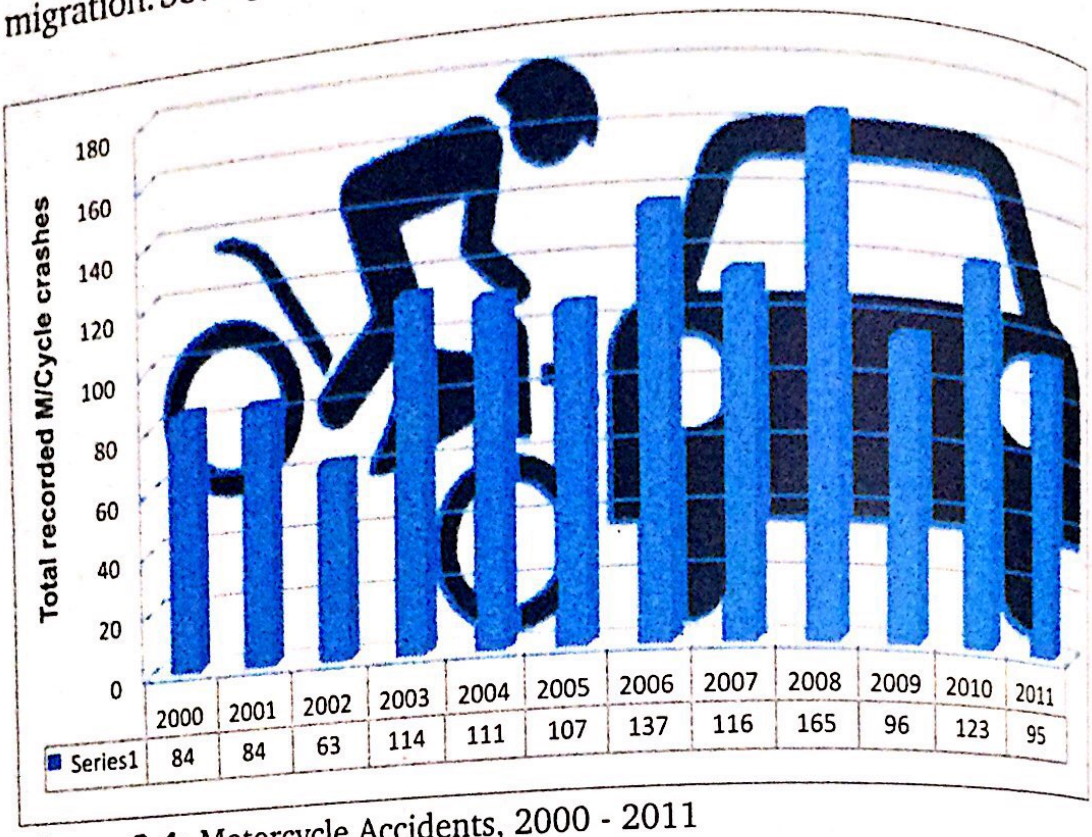


Figure 8.4: Motorcycle Accidents, 2000 - 2011
Source: Morenikeji (2012)

v. Satellite Imagery

These are images of earth surface features taken by different types of satellites or imaging instruments launched into space. Depending on the sensor onboard of the satellite, the images are of different spatial resolutions or pixel sizes (i.e. size of the surface area measured on the ground). Thus, there are both high and low resolution images. The high resolution images include the GeoEye-1 (0.41 meter resolution), Quick Bird (0.6 meter resolution), IKONOS (0.82–3.2 meters resolution), the SPOT series (2.5 meters resolution), NigeriaSat-2 and

NigeriaSat-X (2.5–5 meters resolution), RapidEye (5 meters resolution) and Google earth images. The low resolution images include the Landsat and SPOT series (30 meters resolution and above) as well as the NigeriaSat-1 images with spatial resolutions of 64 meters and above. Figure 8.5 shows an example of low resolution Landsat ETM satellite image.

Generally, satellite images contain ample information, such as meteorological, agricultural, forestry, hydrological, landscape and biodiversity data, which are of wide regional planning application. The high resolution images are suitable for city-level planning, while the low resolution images are used in large-scale regional planning. The images provide access to temporal information or multi-date data taken at different periods of the year and covering many years (e.g. 1970 - 2014) which are suitable for regional planning purposes.

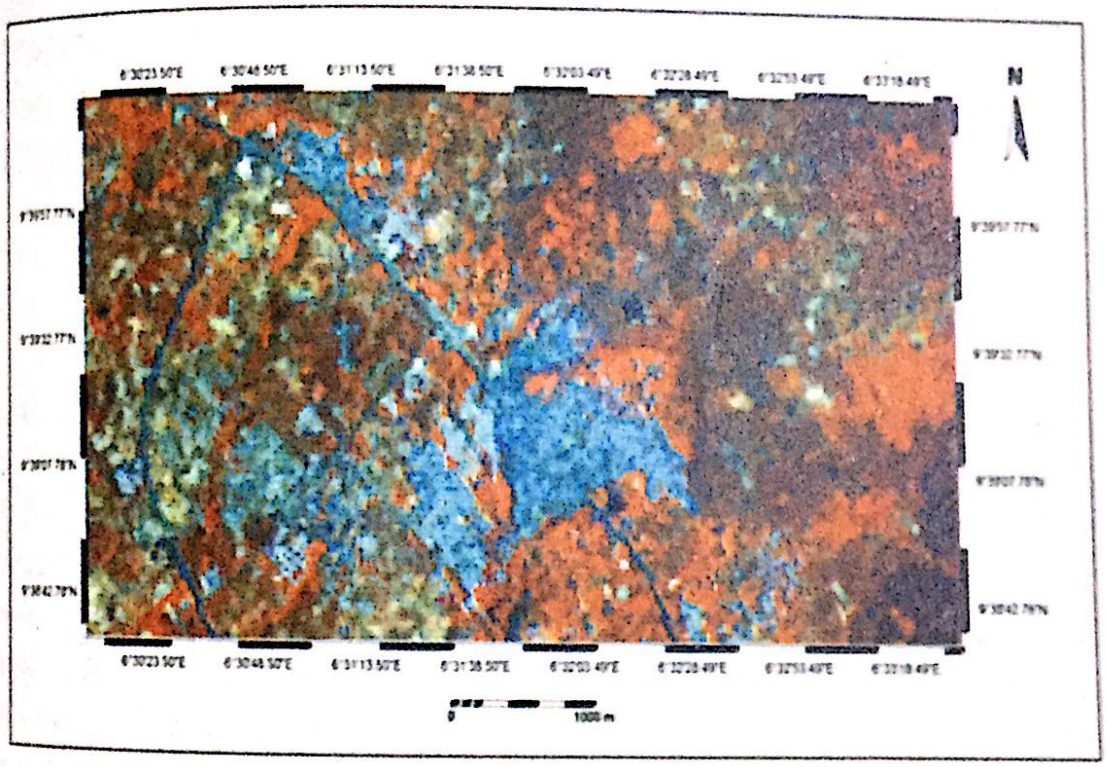


Figure 8.5: Landsat ETM Image of Part of Minna, Niger Sate, 2002

Source: National Centre for Remote Sensing and GIS, Jos, Plateau State.

8.5 Sources and Methods of Information Collection

Data collection, analysis and storage are important exercises in regional development planning. In order to plan for a region, adequate and good quality data is required. However, the collection of information should be guided by a set of pertinent questions. Thus, the following questions must be answered by the collector in order to gather relevant information.

a. What are the available sources of information?
b. What are the most appropriate methods for collecting the information?
c. How will the information be analyzed and presented?
d. What ethical issues such as official permission, confidentiality, etc. are involved and how will they be resolved?

The sources of planning information are diverse. The data gathering process involves the identification of data sources, gaining access to the necessary data and obtaining the data in a useful form. The sources and methods of regional planning information collection include the ones discussed below.

i. Official/Administrative Records

Government agencies and private establishments collect and document data as part of their day-to-day operational activities. The records of such organizations are important sources of planning information. Examples of data that could be collected from administrative records include: land ownership and uses; mineral resource location and distribution; car ownership, traffic volume and movement pattern; births, deaths and migration; and inflow and outflow of commodities. Such data can be collected through personal access to the hard or electronic copies of official records – registers, document files, memoires or diaries, etc.

ii. *Census*

Census refers to a complete enumeration of a geographic region in which data is collected about every unit in a group or population. It is a periodic nation-wide survey conducted to obtain data on every member of the population. Census is conducted in every 10 years in Nigeria. Census figures contain socio-economic and infrastructure information of the areas enumerated. Census contains detailed information on the population sub-groups and sub- units of a country or region. It is, therefore, a useful information source where regional planning data, like population figures and densities as well as facility distribution, could be obtained.

iii. *Field Surveys*

This is a practical exercise in which a researcher embarks on concrete data collection on the field using a variety of data collection instruments. The choice of instrument is influenced by the interest of the researcher, the type of variables involved, the level of accuracy required and the skill of the enumerator. The exercise is normally conducted through the selection of items of a population to represent the entire population – *sample surveys*. Field surveys yield ample data depending on the scale and depth of data collection, and they are a veritable source of both quantitative and qualitative planning information. The different methods and/or sources of planning information under the survey methods include the following:

a. *Interviews:* Planning information could be collected using the different interview methods. Personal interviews may be conducted *face-to-face,* in which the enumerator establishes contact and interacts with the respondents to elicit planning information. This method fosters cooperation between the interviewer and the interviewees and it can yield the highest volume of information, allows the researcher to clarify issues

and seek follow-up information. Other forms of interview include *telephone interview,* in which contact is established with distant responder through communication on phone, and *Computer-Assisted Personal Interviewing (CAPI),* in which rather than using an interview guide, the researcher uses a laptop or hand-held computers/tablets to enter response/ information directly into a database.

b. *Observations:* Planning information could also be obtained through the observation method. Here, the researcher makes observations and/or measurements on the field with or without the participation of the objects of investigation. Types of observation include structured, unstructured, participant, non-participant, controlled and non-controlled observations. The structured observation type ensures the careful definition of unit area to be observed and the manner of recording the observed information, while, in the unstructured type, the researcher is not specific on the unit area or where to collect data and the method of recording information. The unstructured observation is characterized by exploration with a view to discovering things in the surroundings. Irrespective of the type employed by the researcher, the observation method ensures accuracy. It enhances the confidence of the researcher and it is a veritable source of regional planning information.

c. *Questionnaire surveys:* The questionnaire is one of the most widely used survey instruments for planning information collection. It is a device for securing answers to questions by using a form which is completed by respondents (Goode and Hatt, 1952:133, as quoted in Morenikeji, 2006). The questionnaire could be mailed to the respondents or hand-delivered to be completed and returned. It could be web-based, allowing the respondents to complete a questionnaire on a secured website.

d. *Focused Group Discussion:* Focused Group Discussion (FGD) is group discussion involving between six and twelve people led by a skilled moderator who guides the proceedings. It is an open, free and simultaneous discussion in which the participants express their views and/or opinion on the topic of discussion. FGD is a qualitative method of data gathering and the purpose is to obtain in-depth information on the subject under investigation. It is a veritable source of planning information and it can yield detailed information beyond the imagination of the researcher. The FGD is used to complement other methods of sourcing information for regional planning purpose.

iv. *Libraries*

A library is an organized collection of sources of information and similar resources, made accessible to a defined community for reference or borrowing (*Wikipedia Encyclopaedia*, 2014). It is a room or an entire building that provides physical or digital access to books, CDs, Videos and other reference materials. A library is a good and popular source of secondary information that could be obtained from historical records, documents, annals, journals, statistical year book and books.

v. *The Internet*

The Internet is a massive global network that connects millions of computers together globally, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet (*Webopedia*, 2014). The Internet is a major source of planning information in the contemporary times. It provides access to large volume of digital data for a wide community of researchers worldwide. Information on different regions of a country and also the entire world could be collected in different

formats from the Internet for planning purposes, using typical search engines, like Google and yahoo. The Internet is, therefore, an outstanding source of planning information.

8.6 Information Requirements in Regional Planning

The whole essence of regional planning is to achieve efficiency in the use of natural resources to promote the welfare of the population. An inventory of the available natural resources (forestry, water bodies, mineral resources, wildlife abundance, historic sites, etc.) and their distribution is usually carried out to guide their use and prevent their abuse to make them sustainable. The knowledge of the stock and spatial distribution of these resources will influence population distribution, occupation type, location of industries, designation of conservation areas, tourism development, among others.

For the purpose of regional planning, the collection and analysis of data on natural resources are best done using a combination of satellite imagery and other ground data. Depending on the scale of analysis and level of details required, Landsat, SPOT and Quick Bird images of different resolution levels are required and different types of Geographic Information System (GIS) software that can complement one another are available for analyzing satellite imagery and other telemetry data on human and natural resources collected from ground sources.

The information required for regional planning is large and diverse. The collection of various types of regional planning information is usually costly. However, for academic and non-commercial uses, some organizations provide free regional planning information and GIS (satellite) data for researchers. Some of the notable sites where free data and satellite images can be downloaded are listed below:

i. *Sources of Ground/Land Information*

http://data.worldbank.org/country/nigeria
http://www.afro.who.int/en/nigeria/who-country-office-nigeria.html
http://www.population.gov.ng/
http://web.ng.undp.org/nigeriamdgs.shtml
http://www.population.gov.ng/
http://www.nigerianstat.gov.ng/sectorstat/sectors/
http://www.nigeria.gov.ng/...environment/182-federal-ministry-of-
http://wwwenvironmen.www.abujagis.com/services.html
http://www.gmswebng.blogspot.com/2012/.../mineral-resources-in-nigeria-and_07.h
http://www.lagos-nigeria-real-estate-advisor.com/land-information.html
http://www.findnigeriaproperty.com/blogproperty/adding-property-on-fnp/

ii. *Sources of GIS Data*

http://www.google.com/earth/download/ge/agree.html
http://grasswiki.osgeo.org/wiki/Global_datasets
http://download.geofabrik.de/
http://www.naturalearthdata.com/downloads/
http://earthexplorer.usgs.gov/
http://topotools.cr.usgs.gov/GMTED_viewer/
http://www.mapmakerdata.co.uk.s3-website-eu-west-1.amazonaws.com/library/stacks/Africa/Nigeria/index.htm

8.7 Analytical Techniques for Regional Planning Data

It has been earlier emphasized that effective planning depends on informed knowledge which comes through intelligent data gathering, analysis and interpretation. Quite a number of books have been written on planning procedure, analytical techniques, quantitative

methods and report writing by several authors (Okoko 2000; Abumere 2004; Morenikeji 2006). Although the contents of these books are still relevant, there is a constant need to revise the analytical methods in line with changing technology. For instance, the cartographic methods and the available technology define how much of data can be processed, how much information can be displayed and the quality of reports that are produced.

One cannot overemphasize how much the world has changed from the "handigraphic" era, when only little information can be cartographically put on static maps to the "compugraphic" era, when multivariate analysis can be carried out and outputted on dynamic maps with several layers in Geographic Information System (GIS) environment. Also in terms of graphical display of data in charts and graphs, cartography has moved to a new level called "infography" so that instead of data display we now talk of data visualization. Computer-aided statistics and computer-aided graphics are now the most valued contemporary techniques for data analysis and display.

There are many analytical techniques for handling and processing of regional data. These include simple population and housing projection methods as well as modelling techniques, such as the gravity model for predicting traffic origin and flows among regions. Important analysis involving resource appraisal, land capability studies and land use classification can also be handled by GIS technique. Various menus in GIS software are designed to help classify land uses into categories like forested, rocky, farm land, water body and built-up areas. The areas occupied by each land use type can be calculated and landscape analysis of slope, drainage and direction of water flows can be mapped through digital elevation/terrain analysis and modeling. The GIS tool is capable of handling map processing operations, such as data capturing (description of geographic features), data query (finding specific location of features on the earth's surface), data analysis (data processing, overlay and display) as well as information storage and retrieval. Some of the

versatile GIS software types that can perform these operations include ARCMAP 10 by ESRI, MAPINFO, SUPERMAP, IDRISI, TNT, WORLD MAPPER, MAPTITUDE, MAPMAKER, and ILWIS. These and other free open source GIS software with several modules can handle both vector and raster data for spatial mapping at the regional level.

8.8 Practical Examples of Regional Planning Data Analysis

Data analysis in regional planning is done to meet several objectives. Different forms of analyses are carried out to derive facts or make conclusions on any regional phenomenon of interest. Few practical examples of such analyses are provided here for better understanding.

A. *Population Projection*

Population is the total number of people living within or interacting within the study area. It is one of the most crucial factors in regional planning. Its over- or under-estimation can lead to over- or under-utilization of resources, respectively. It is multi-dimensional and failure to recognize this fact may seriously jeopardize planning. For instance, not taking into consideration the population that live elsewhere but work in or trade within the planning region will lead to overstretching of facilities, such as is being experienced in Lagos. The difference between day and night populations may be very crucial for facilities planning for any planning region. Thus, the population characteristics that must be studied and analyzed for planning purposes are the total number, fertility rate, mortality rate, age distribution, sex composition and migration. However, because the current population data is almost non-existent during the planning period, recourse is usually made to the past censuses' data which are then projected to the current year and into the future.

Procedure for Population Projection

The first step in the procedure for population projection is to obtain the population growth rate. This is usually issued officially by the agency responsible for the conduct of census, i.e the National Population Commission in Nigeria. Where the growth rate is not known, the rate has to be calculated by the researcher. For instance, if the population of Nigeria in 1991 was 88,992,220 and that of 2006 was 140,431,790, the relative change in population can be calculated using:

$$P_c = \frac{P_2}{P_1}$$

where Pc = Population change ratio
P1 = Population at the initial date
P2 = Population at a later date

$$\text{i.e. } P_c = \frac{10431790}{88992220} = 1.6$$

Next is to calculate the year interval (2006 – 1991 = 15 years) and then substitute this in the equation viz: $\frac{P_2}{P_1} = (1+r)^n$

where r = annual rate of growth
n = year interval

This can be converted to logarithms format for easy calculation thus:

$$\log \frac{P_2}{P_1} = n \log(1+r)$$

$$\log (1+r) = \frac{\log \frac{P_2}{P_1}}{n}$$

Next is to substitute the values in the formula:

$$\log (1+r) = \frac{\log 1.6}{15} = \frac{0.20412}{15} = 0.013608$$

i.e. $\log (1+r) = 0.013608$

$(1+r) = 1.03183$ (antilog of 0.013608)

$r = 1.03183 - 1$

Therefore, the growth rate (r) = 0.03183 or 3.2%

Note that the National Population Commission of Nigeria has census figures for several years dating from 1911 and, therefore, has inter-censual growth rates which enable the Commission to make pronouncements on official growth rates for urban areas, rural areas and the entire country from time to time.

To project the population to year 2015, we now use a simple formula:

$Pt = Po (1+r)^n$ Where:

P_o = Population at the initial date
P_t = Population at the future date
r = Annual rate of growth
n = Time interval ($P_t - P_o$) i.e. 2015-2006

Thus:

$P_{2015} = 140,431,790 (1 + 0.03183)^9$
$= 140,431,790 (1.03183)^9$
$= 140,431,790 (1.3258)$
$= 186,184,467$

Therefore, the projected population for 2015 is 186,184,467.

Population indices needed to plan for social infrastructural facilities

The above simple projection method can be used to determine the future population of a planning region. However, in order to determine the type, size and number of social facilities to serve the population in a region, salient characteristics of the population must be understood. These include the

following.

i. **Sex Ratio**: This is defined as the proportion of males to the females in a given population. The formula is:

$$\frac{Number\ of\ males}{Number\ of\ females} \ X\ 100$$

ii. **Dependency Ratio** = ratio of the dependent population (defined children under 15 years and adults over 65 years) to that of the adult population (ages 15 - 64 years) expressed per 100, that is:

$$\frac{Children\ under\ 15\ years + Adults\ over\ 65\ years}{Adults\ between\ 15\ and\ 64\ years} \ X\ 100$$

iii. **Young Dependency Rate** = $\frac{Children\ under\ 15\ years}{Adults\ between\ 15\ and\ 64\ years} \ X\ 100$

iv. **Old Dependency Rate** = $\frac{Adults\ over\ 65\ years}{Adults\ between\ 15\ and\ 64\ years} \ X\ 100$

v. **Crude Death Rate**: This is the ratio of deaths to the total population expressed per 1,000 populations and it is given as:

$$\frac{Number\ of\ deaths}{Total\ Population} \ X\ 1000$$

vi. **Crude Birth Rate**: This is the ratio of births to the total population expressed per 1,000 populations and it is given as:

$$\frac{Number\ of\ Babies\ 0\text{-}1\ year}{Total\ Population} \ X\ 1000$$

vii. **Ageing Index:** Ratio between old and young people in the population, given as:

$$\frac{Adults\ over\ 65\ years}{Children\ below\ 15\ year} \ X\ 1000$$

vii. **Ageing Index:** Ratio between old and young people in the population given as:

$$\frac{Adults\ over\ 65\ years}{Children\ below\ 15\ year} \quad X\ 1000$$

viii. **Natural Increase: This expresses the rate at which a population is increasing or decreasing and it is given as:**

$$Crude\ death\ Rate - Crude\ Birth\ Rate$$

B. *Transportation - Traffic Flow Prediction*

Freight and population (passenger) flow statistics are essential for regional transportation planning. Requisite data is usually obtained through household or roadside surveys after which such data are subjected to modelling. The gravity model is a popular analytical method used in freight and population flow in transportation studies. Explaining the gravity model, the original Newton's law states that "two bodies attract one another with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between them". This law has found useful application in planning, especially in transportation. It is now possible to predict how trips originating at a particular region will be distributed to other regions. The formula is given as:

$$T_{ij} = G * \frac{P_i P_j}{dij^{\lambda}}$$

where:

T_{ij} = flows from place i to j

Pi & Pj = measure of mass (population) of places i and j

Dij = distance between p and j

λ = best fitting distance exponent usually set between 1 and 3

Supposing there are four districts with the following population (P):
Minna = 145,000
Bida = 130,000
Suleja = 115,000
Agaie = 64,000

Mean trip rate per month for the study area (k) = 2.8
The distance separating the districts from each other is also given as follows:

Table 8.1: Distance Matrix

District	Minna	Bida	Suleja	Agaie
Minna	42	84	120	196
Bida	84	42	174	35
Suleja	120	174	87	139
Agaie	196	35	139	18

Source: Authors' Analysis (2014)
Note: Distance from a place to itself is usually taken as half the distance between that place and its nearest neighbour.

First, calculate G using the following formula:

$$\frac{k}{\frac{P1}{d_{1\text{-}1}} + \frac{P1}{d_{1\text{-}2}} + \frac{P1}{d_{1\text{-}3}} + \frac{P1}{d_{1\text{-}4}}}$$

Thus:

$$G_1 = \frac{2.8}{\frac{145000}{42} + \frac{130000}{84} + \frac{115000}{120} + \frac{64000}{196}} = 0.000445515$$

Finally, calculate T_{ij} for T1-1, T1-2, T1-3, T1-4 and T1-5

$$T_{1\text{-}1} = 0.000445515 \; X \; \frac{145000 \; X \; 145000}{42} = 223{,}022.69$$

$$T_{1\text{-}2} = 0.000445515 \; X \; \frac{145000 \; X \; 130000}{84} = 99{,}975.69$$

$$T_{1\text{-}3} = 0.000445515 \ X \ \frac{145000 \ X \ 11500}{120} \qquad = 61{,}908.02$$

$$T_{1\text{-}4} = 0.000445515 \ X \ \frac{145000 \ X \ 64000}{196} \qquad = 21{,}093.77$$

Table 8.2: Actual and Predicted (Tij) Values

	Population	Distance	G	Tij	%	Trips (pop*2.8)
Minna	145,000	42	0.000445515	223,023	54.94	406,000
Bida	130,000	84		99,976	24.62	
Suleja	115,000	120		61,908	15.25	
Agaie	64,000	196		21,094	5.20	
				406,001	100	

Source: Authors' Analysis (2014)

For Minna with a population of 145,000 people and a mean daily trip rate of 2.8, a total of 406,000 trips will be generated. The model predicts that 54.94% (223,023) of the trips will terminate within Minna, 24.62% in Bida and 15.25% in Suleja. Agaie with the lowest population and farthest distance from Minna is predicted to receive 5.20% of the trips.

Better prediction can be made through iterations particularly by varying the distance exponent (λ) or weight attached to the population (G).

C. *Housing Needs Projection*

The projection of housing need of different settlements within a region or a country is another important regional planning exercise. The quantitative techniques for estimating housing need are many and are still evolving, with the UN agencies, especially the UN-HABITAT, at the forefront of the struggles. Series of formulae for housing need projection are available in the literature, some of which include the following.

$E(t) = E + U + H(t) + r^{u(t)}$; ....(1)

where:

E(t) = Housing need for time t

E = Number of households without shelter as at the beginning of the period covered by the estimate.

U = Number of unacceptable living quarters in the inventory as at the beginning of the period covered by the estimate.

H(t) = the projected increase in the number of households during the period.
covered by the estimate.

R = % rate at which acceptable living quarters will need to be replaced during the period covered by the estimate.

A modification to the above formula was later given as follows:

$E(t) = k (E_1 + E_2 + E_3 + E_4 + E_7(t) + E_5 + E_8(t)$ .....(2)

E(t) = Housing need for period t

k = coefficient to allow for vacant dwellings.

E_1 = number of living quarters required for households without shelter.

E_2 = number of acceptable living quarters required for households occupying quarters of unacceptable standard.

E_3 = number of acceptable quarters required to provide separate accommodation for households involuntarily double-up with other households in living quarters of acceptable standard.

E_1 = number of living quarters required to reduce levels of density (person/room) in acceptable living quarters to a desirable level.

E_1 = number of living quarters to replace living quarters which are of unacceptable type and beyond repairs at the period covered by the estimate.

E7(t) = number of living quarters that will be required to house projected increase in the number of households covered by the estimate period.

E8(t) = number of living quarters required to replace living quarters of an acceptable type which will be lost from the inventory during the period (t) covered by the estimate.

In view of the quantity of data demand by these formulae and considering the fact that such data are not easy to come by in the developing countries, the UN came out with a simpler formula:

$$H = \frac{1}{k}\left(\frac{p}{hs}\right) \qquad (3)$$

where:

H = Housing need

p = Population

hs = average household size

k = number of households that occupy a single room and is a unit of enumeration.

These and many other formulae could be used in housing need projection. However, for our practical example, the following formula, as used by Jinadu (2007), is adopted.

$$Fhr = Fhn + r + s \qquad (4)$$

where:

Fhr = Future housing units required

Fhn = Future housing need

r = Number of housing units to be replaced

s = Shortfall in the present housing stock

Assuming the figures in Table 4 are for city A in Nigeria as at 2005, the housing need of that city by 2020 could be estimated using equation 4 above.

Table 8.3: Hypothetical Statistics for Housing Need Projection

Population	350,000
Growth rate	2.0%
Average Household size	6.5
Current housing stock	40,000
Uninhabitable units	2,500
Replacement need	2%
Homeless people	2%
Vacancy rate	3%

Source: Authors' Analysis (2014)

The first step in the procedure is to determine the population of city A at the target year (2020) using the formula:

$Pt = Po(1+r)^n$ Where:

Po = Population at the initial date
Pt = Population at the future date
r = Annual rate of growth
n = Time interval (Pt – Po)

Therefore:

$Pt = 350000(1+0.02)^{15}$
$Pt = 350000(1.02)^{15}$
$= 350000(1.02)^{15}$
$= 350000(1.346)$
$= 471,054$

Therefore, the population of city A in year 2020 is 471,054
Determine the shortfall by calculating the number of habitable units and the number of household in the total population. This is given as:

Total stock – Uninhabitable housing units
40,000 – 2,500 = 37,500
Existing habitable houses = 37,500
Number of households in the population
= Population/mean household size
=350,000 / 6.5 = 53,847 households

Determine the shortfall at the base year (2005)
Note: The assumption is that every household require one housing unit.
= 37,500–53,847 = -16,347 (housing deficit).....1

Existing number of the homeless (squatters) = 2% of 350,000 (total population) = 7,000/6.5 (mean household size) = 1,077 squatter households.

Determine the replacement need
2% X 40,000 = 1,600
1,600 per year X 15 years = 24,000.....2

Number of households in the target year (2020)
= Projected population / mean household size
= 471054 / 6.5 = 72,470

(Target year household – Accommodated household at the base year)
= 72,470 – 37,500 = 34,970

Need = 34,970 + 1077 = 36,047 3

Total future housing need (add ...1 + ...2 + ...3)
= 16,347 + 24,000 + 36,047 = 76,394 4

Add 3% vacant dwelling = 76,394 (0.03) = 2,291
Projected Future Housing Need = 76,394 + 2,291 = 78, 685

Therefore, city A will need 78, 685 housing units to accommodate its population by year 2020. This means about 2,746 new houses have to be produced each year for 15 years to meet the housing need of the city at the target year.

D. Establishing Need-Gaps

This involves finding the difference between what ought to be (based on acceptable standard) and what is. For instance, in planning for water supply for a population in a region, we have to consider either the national target or international standard. For instance, the Third National Development Plan set a target of 112 litres per capita and at the end of the plan period only 13.3 litres was achieved, which was far below the WHO 180 litres per person standard.

The need-gap of a range of facilities is normally determined using

existing planning standards. These standards are derived from many sources, particularly from the works of Vagale (1971). Table 8.4 contains examples of specified planning standards that could be used to determine regional need-gap for a range of social facilities in a region.

Table 8.4: Standards for Planning Community Facilities

	Population	Area (hectares)
Nursery School	1,500	0.2 + Playfield
Primary School	3,500	1.0
Secondary School	15,000	2.0
Tertiary Institution	50,000	3.0 – 4.0
Dispensary	5,000	0.1
Health Centre	20,000	0.4 + Staff Quarters
Hospital	50,000	2.0
Telecommunication	10,000	0.1
Postal services	100,000	0.2
Power sub station	50,000	0.2
Police Station	10,000	0.2
Police station (major)	50,000	0.8 + Staff Quarters
Fire Service	50,000	0.8
Children's Park	2,000	0.2
Neighbourhood Playground	1,000	0.2
District Park	25,000	5.0
Regional Park	100,000	40
Cemetery	10,000	0.4

Source: Compiled by the Authors, 2014

An example of the use of these standards could be demonstrated with the case of the provision of primary schools in a city or region. Assuming a place with population of 182,428 has a total of 17 primary schools, based on the standard of 1 (one) primary school per 3,500 population as indicated in Table 5, such a place is expected to have 52 primary schools (i.e. 182,428 /3,500). Since the city has only 17 primary schools, the need-gap (deficit) is 35 primary schools (i.e. 17 – 52 = -35).

The above cases are few examples of analysis of information for regional planning purposes. Several other examples could be given, most

especially in the area of facility distribution and regional land use analysis. The readers will, therefore, find other complimentary sources that deal with various aspects of data analysis for regional planning very useful. The last section of this chapter is devoted to the challenges of data collection and analysis in developing countries.

8.9 The Challenges of Regional Data Collection and Analysis

Regional development planners and researchers face series of challenges in the collection and analysis of data. Some of the problems faced are socio-cultural, economic and technical in nature. The most common problems experienced by researchers include the ones discussed here.

i. *Financial constraints:*- Data collection, most especially at the regional level, requires a lot of financial resources. However, there is no adequate budgeting for data collection and processing. Many information-based agencies, like the National Bureau of Statistics, National Population Commission, and Nigerian Meteorological Agency, etc. in Nigeria often face financial constraints that limit their periodic data collection exercises. At the level of the individuals, researchers face huge financial constraints, most especially in securing data from commercial agencies. Multi-date data, such as satellite imagery, air photographs, and climate statistics are often very expensive for individual researchers, like lecturers and students of higher institutions. Thus, paucity of fund has often limited the volume and quality of regional planning data in Nigeria.

ii. *Old and inadequate statistics:*-The existence of old and inadequate data is the bane of research in many African countries. There is a general problem of paucity of data. Where the data are available, they are often stale and not suitable for contemporary research. Quite a large volume of stale data exists in many organizations, which require update. The existing information base has not been updated for many years owing to financial constraints and administrative neglect, amongst others.

iii. *High level of illiteracy:-* High proportion of illiterate population in Nigeria and many other African countries make data collection exercises very tedious, with low output. In most cases, the illiterate people are unable to supply the much needed information to researchers and this makes the process of questionnaire administration very cumbersome and time-wasting. Also, the illiterate members of the community do not value or appreciate the importance of research information. Thus, they are often suspicious and unwilling to give information to field enumerators.

iv. *Uncooperative attitudes of respondents:-* Lack of cooperation with the researcher or enumerator is a major constraint of information collection in Nigeria and many other part of the developing world. Both government institutions and individuals in the community see the researcher as an intruder into their privacy or busy schedules. In many public establishments, information is regarded as official secret and much frustrating protocol is involved in data collection from such institutions. Generally, little or no attention is given to answering questions or completing a questionnaire; and, in some cases, respondents refuse to volunteer information they consider private, e.g. age, income level, household size, and sources of livelihood.

v. *Poor record-keeping attitudes of public institutions:-*Improper record keeping by public and private institutions is a serious problem in the developing countries. In many of these establishments, most information still exists in old and tattered files. The existing documents are often scattered in bits, not properly collated and stored for easy retrieval. Many of these institutions are yet to computerize their records and this often results in missing data or data loss. Thus, researchers find it difficult to access comprehensive data from these institutions.

vi. *Poor accessibility to remote areas:-* Regional planning deals with all issues in an entire region, including the problem and/or remote areas. Many rural areas, both in the coastal regions and the hinterlands, are not easily accessible owing to poor roads. Poor accessibility, therefore, limits

the volume and coverage of information collection and is a major challenge to researchers.

vii. *Limited skills and knowledge of appropriate statistical techniques to use:-* Applying the appropriate statistical techniques to the often times voluminous regional data is a major challenge for many researchers. Though there are many computer packages for data analysis, they have been found to be grossly abused by novice data analysts. Various statistical methods have their own assumptions to be met before they can be meaningfully applied and these assumptions must be understood from the beginning. For instance, parametric statistics cannot be applied to data collected based on nominal scales (yes or no type of response in a questionnaire).

viii. *High cost of software for data analysis:-* The volume of data required for regional analysis could be enormous, requiring the use of computer software. Such software, like Statistical Package for Social Science (SPSS) or STATISTICA and other GIS software, like MAPINFO, IDRISI, TNT, MAPMAKER and ILWIS, are very costly. Thus, inadequate access to the required analytical tool makes data processing difficult.

8.10 Conclusion

It is widely acknowledged that regional planning is a data-intensive exercise. It utilizes a variety of planning information from a wide range of sources – administrative records, field surveys, library and the internet. The collection and proper analysis of planning information is very important in regional planning. However, many researchers face daunting challenges in the collection and analysis of planning information. As discussed in this chapter, the common problems include inadequate data due to poor record keeping and updating attitudes of responsible institutions, high cost of data collection and analysis, accessibility problem and the uncooperative attitudes of the largely illiterate respondents who make data collection difficult and strenuous.

In view of the importance of data collection and analysis in regional planning, these problems need to be resolved. This could be achieved through capacity-building and proper funding of the agencies involved in data collection and data banking in Nigeria. Besides, other public and private institutions should be mandated by law and encouraged to maintain up-to-date information base for easy access to researchers and development planners. Above all, data collected for regional planning purposes require proper processing to yield the desired information. Efforts devoted to improving access to data will be meaningless if attention is not paid to the training of the new generations of town planners in modern GIS and computer-based analytical methods. It is, therefore, recommended that research/analytical methods and GIS training be given serious attention in Nigerian planning schools.

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