DATABASE DEVELOPMENT FOR DESCISION MAKING IN SCHOOLS

A CASE OF OUR LADY OF FATIMA GIRLS SECONDARY SCHOOL, SABON TASHA, KADUNA.

By

SIM HARUNA
M.Tech./SSSE/975/2003/2004

DEPARTMENT OF GEOGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

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DISSERTATION SUBMITTED TO THE DEPARTMENT OF GEOGRAPHY, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY IN REMOTE SENSING APPLICATIONS.

APRIL, 2005.

CERTIFICATION

This is to certify that this Dissertation has been read and approved as meeting the requirements of the award of Masters of Technology in Remote sensing applications, Department of Geography, Federal University of Technology, Minna.

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DEDICATION

I dedicate this project to

God Almighty for His mercies endureth forever.

My sweet mother, Mrs. B.A. Dawa for her love, support and sacrifice.

My beloved Father and priest Rev. Fr. Mike Waters.

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ABSTRACT

This research demonstrated the use of Geographic Information System (GIS) in database development for decision making in schools using Our Lady of Fatima Girls Secondary School, Kaduna as a case study. In a developing country like Nigeria where schools make use of analogue method of decision making procedure for development activities and infrastructure facilities there is need to strike a balance. Administrators and decision makers require an efficient database which will assist them to get the updated scenario of the school. Two forms of data were obtained and used for the research; the S*patia*l and A*ttribute* data. The cadastral map of the school was scanned and imported into Arcview 3.2a software. This was then digitized on-screen into themes and the corresponding attribute information linked with them for appropriate query, manipulation and logic operations. The results such as the query performed from the database created proved that GIS database is an efficient medium and tool for effective planning and decision making. The GIS based information system will help the school administration in planning, implementation and monitoring of various projects for the school development in different fields at a much faster rate which will in turn make the school better developed.

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CHAPTER ONE

INTRODUCTION

1.1 Study background

The school system has been in existence for a very long time in different parts of the world. As a result of the complexities of the school system in modern days it becomes important to find means of coping with the pace of development in the system. Moreso, the school is constantly being faced with increasing number of students being enrolled which will mean a need for more teachers, infrastructure as well as records to be kept, Data generated by schools on students, staff, infrastructure, etc are enormous but poorly maintained and in most cases not readily available.

The study area still depends on analogue method of handling information for its planning and decision-making which is tedious and time consuming. This can be carried out efficiently and in the shortest time with the use of Geographic Information System (GIS).

More and more of spatially referenced information is being maintained in GIS that are designed to accept large volume of spatial data derived from a variety of sources and efficiently store, retrieve, manipulate, analyze and display these data according to user designed specifications (Ehlers, 1997).The contribution of the rapid advancement and innovations in the applications of GIS to planning and decision making is much more. Being a primary tool for planning and decision making, it has been very useful for development as a whole. Those with geospatial information have the capability to evaluate situations and make notable manipulation positively on them. It is this realization that has made many organizations both private and public to develop spatial

databases which enable the use of on-line data and information that are available to initiate systematic application for developmental planning and decision making in general.

In this research work GIS is mainly used for analysis, which in developing countries, only few GIS projects are successfully applied and utilized for decision making. The work indicates the problem of the school and possible future problems which may lead to construction of new buildings in order to meet up with demand. GIS will make the procedure of locating new buildings more smoothly and effective by integrating all the data together.

1.2. **Statement of the Research Problem.**

A survey of some randomly selected schools in Nigeria shows that data on students, staff records and school's infrastructure are being handled manually. This has posed a lot of problems due to the fact that manual handling is cumbersome and makes decision making slow and inefficient.

Information constitutes the primary tool for planning and decision-making. According to Kufoniyi (2001) Nigeria is a sleeping giant who has been left sleeping as far as information technology break through is concerned. Countries like Ethiopia, Ghana, Burkina Faso, and even the Republic of Benin are ahead of her in terms of digital mapping and Geographic Information System (GIS). A gap, a very big gap for that matter has been created, and Nigeria is trying to bridge the gap which is posing a challenge. That gap can be bridged by moving from analog to digital era. Consequently, up to date information is not readily available in schools. For example, accurate information on the

number of staff and students will aid in knowing whether the capacity of available infrastructure is adequate or not. Assessment of staff and students performance is difficult to achieve manually. This is often compounded by high level of inaccuracy, misplacement of files and inadequate information. With inadequate information on the number of students to be enrolled in the school, allocation of students into classes and/or hostels, recruitment of staff as well as transfers and replacements to avoid cases of some departments being under staffed while others are over staffed, buildings to be constructed or renovated as well as the most suitable locations for new projects, maintenance of school records and the knowledge of facilities should not constitute serious problems. This can be adequately handled by Geographic Information system (GIS) which gives both the graphical display of spatial data as well as their attributes and at the heart of GIS is the database (Ajibade, 2001).

Therefore, this study emphasises on the importance and the need for database development as a decision-making tool towards effective education (schools) planning and services, using Our Lady of Fatima Girls Secondary School, Kaduna as a case study.

1.3 Aim and Objectives

The aim of this project is to develop a database for effective decision making in our schools with Our lady of Fatima Girls secondary School, Sabon Tasha, Kaduna as a case study.

The study has the following summary of objectives:

i. To assess the existing information system used in the school.

ii. To develop a geospatial database to support the information system of the school for decision-making.

iii. To illustrate different ways in which decision making can be aided using the geospatial database.

iv. To make recommendations towards effective GIS database creation for effective decision-making in schools.

1.4 Scope and Limitations of the Study

1.4.1 **Scope:** This study laid emphasis on database development for decision-making in schools, particularly with Our Lady of Fatima Girls Secondary School, Sabon Tasha, Kaduna, being one of the leading and most organized missionary schools in Kaduna metropolis. It occupies about 7,034 hectares of total land surface.

1.4.2 **Limitation:** The use of Geo imagery was not incorporated in this research work which would have given high level of tractability and integrity.

1.5 Justification of the Study

In decision-making a number of options or criteria are put into consideration in order to make do with the best. The importance of GIS database for school decision making cannot be under estimated. A GIS database will aid decision makers with updated information of the school to enable them improve it by taking quality decisions. Information constitutes the primary tool for planning and decision making. In developing countries, GIS data and spatial information data is not available or not open to the public (Makino and Watanabe, 2002). Kufoniyi (2001) reported by Ajibade (2001) sees the analog era and the digital era as a very big gap posing a challenge that needs to be

bridged. Unfortunately schools still operate in the analog era. A GIS database for school decision making will go a long way in facing this great challenge by providing such data and information and integrating them. A GIS database has the following advantages; It:

(a) Gives an up to data/information on the school of both spatial and attributes data.

(b) Aids quick retrieval, updating and dissemination of information.

(c) Gives very high accuracy, precision and saves time.

(d) Has ability to be queried i.e. allow selection of items.

(e} Allows sharing of data and removes redundancy.

(f) Make future problems to be easily identified or foreseen and tackled in good time e.g. student population growth which will lead to the need for increased infrastructure, employment of more teachers and acquisition of more teaching facilities or curtailing students enrollment to a manageable size, knowing the capacity of available infrastructure and the possibilities at hand.

All these are presently done manually which may be cheap but tedious, time consuming and in some cases inaccurate. Development of a database for decision-making in Our Lady of Fatima Girls Secondary School, Kaduna therefore, will bring about good and timely decisions, which will aid in areas such as budget, enrollment and its development as a whole and in the long run the benefits will greatly outweigh the cost.

1.6 Environmental Background of the Study Area

1.6.1 Geographical location of Kaduna Town.

Kaduna state (Fig.1.1) occupies almost the central portion of the Northern Nigeria between longitudes 06^0 10' and 09^0 00' east of the Greenwich Meridian and latitudes 09^0

10' and $11^{0}30'$ north of the equator. The entire land structure consists of an undulating plain with hills as one move to the southern part. It occupies a land area of about 20,000 hectares with population of over 500,000 people and an estimated annual growth rate of 2.83% (N.P.C., 1998).

1.6.2 **Climate.**

Kaduna State experiences a typical tropical continental climate with distinct seasonal regimes oscillating between cool to dry hot and humid to wet. This seasonality is pronounced with cool to hot dry season longer than the rainy season. The dry season lasts from November to mid-April, while the rainy season lasts for 5-6 months starting from mid-April to October. A major factor responsible for the climatic variations in Kaduna and which affects all climatic elements is the seasonal movement of the Inter-Tropical Discontinuity (ITD) or the Inter Tropical Convergence Zone (ITCZ) which is the meeting zone of the two principal air masses that prevail in Nigeria.

The ITD brings Kaduna under the influence of the continental air mass known as the North-Easterly wind which is dry and dusty blowing across the Sahara. This air mass prevails during the dry season. The dry tropical continental air mass (TC) arrives in the country from the North in October and retreats in March.

The South-westerly wind blowing from the Atlantic Ocean brings Kaduna under the influence of the tropical maritime air mass (MT) which enters the country through the South. These winds are moisture laden and responsible for the rainy season which sets in by March and lasts till September/October.

The mean annual temperature is about 32.2^{0}C. The highest monthly mean temperature is 36.6^{0}C and the mean minimum temperature recorded for five years duration is 14.5^{0}C.

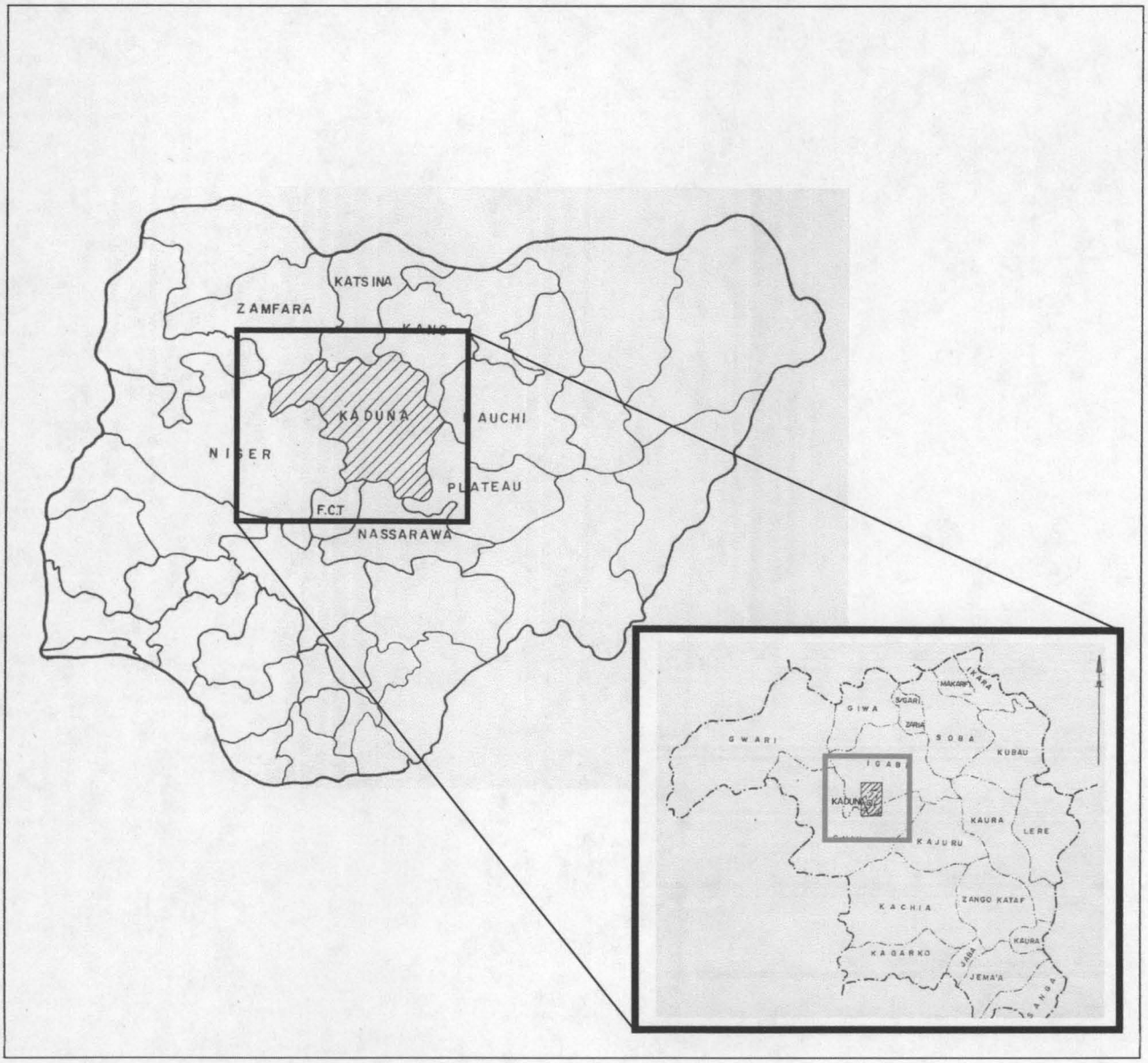


Fig.1.1: Map of Nigeria Showing the Location of Kaduna State and the study Area

1.6.3 **Soil and Vegetation**

The state extends from the tropical grassland known as the Guinea savanna to the Sudan savanna moving northwards. The vegetation is made up of grasses with big trees, which grow shorter as it approaches the Sudan savanna. The soils are typical red- brown to red-yellow tropical ferruginous soils. The soils in the upland areas are rich in red clay and sand but poor in organic matter. However, soils within the "*Fadama*" areas i.e. alluvial soils are rich in Kaolinitic clay and organic matter.

1.6.4 **Drainage pattern**

River Kaduna is the main River in the town. It has good drainage system through which water is channeled to the rivers especially during the rainy season. The rivers serve as sources of domestic and industrial water supply to the state. The water is also used for irrigation (dry season farming) during the dry season.

1.6.5 **Natural Resources and Landuse**

The natural resource endowment range from solid minerals, agriculture (crops and livestock) and forestry. The minerals include Magnetite and Hematite locally exploited for making local iron implements. Graphite, Kyanite and Rutile are in large quantities but under utilized; they are good raw materials for ceramic industries, pencils and welding electrodes. Sand, granite rocks and clay are in good quantities and are being exploited for building.

The main agricultural activities include growing of crops such as maize, guinea corn, millet, ginger, cassava and yam. Livestock rearing though on the low side, is increasingly being practiced in the state. This is greatly being supported by good veterinary services offered by the various agricultural outfits in the state such as the agricultural project at Samaru Kataf, Colleges of Agriculture in Kaduna and Zaria, Federal Livestock department Kaduna, School of Veterinary Medicine (A.B.U.) Zaria and The National Animal Production Research Institute (NAPRI) Shika, Zaria. Forest reserves are found in Sanga Local government area of the state, Mando-Buruku areas and along Kachia road.

The land use on the other hand include: residential, agriculture, commercial, recreational, institutional, religious and industrial. The industries are mostly located in the southern part of the metropolis while others are interwoven.

1.6.6 **Transportation**

Kaduna State is one of the states in the country with good road network such as the Kano-Kaduna-Abuja dual carriage way, Kaduna-Jos, Kaduna-Lagos and Kaduna-Makurdi roads.

The Kaduna-Lagos and Kaduna Port-Harcourt rail lines are the two major rail lines linking Kaduna with the southern cities of the country. From Kaduna the rail lines extend northwards to Kano, Nguru in the North-East and Kaura Namoda in the North-West. Kaduna State has an international airport, which was commissioned in 1982. Airlines operate flights daily to and from Kaduna town.

1.6.7 **Communication**

The Nigerian Telecommunications Ltd. (NITEL) provides telephone services in Kaduna along side new communication outfits such as the MTN, M-tel, Vmobile and Glo communication Network. NITEL and private ISPs provide internet services. The Nigerian Postal Services (NIPOST) and several Courier companies also operate in Kaduna.

1.6.8 **The people**

Kaduna is made up of so many ethnic groups with so many spoken languages. The main ethnic groups are Gbagyi, Bajju, Atyap, Jaba, Hausa and Fulani. English and Hausa languages are widely spoken.

1.6.9 **Occupation**

About 70% of the states population is engaged in peasant farming, producing both food and cash crops. The state can also boast of highly skill man power in almost all field of human endeavour. The state is known as the centre of learning because of the large number of institutions of higher learning like the famous Ahmadu Bello University (ABU), Kaduna Polytechnic, Nigerian college of Aviation Technology Zaria , Nigerian Defense Academy Kaduna, Command and Staff College Jaji, Federal college of Education Zaria, Kaduna State College of Education Kafanchan, College of Agriculture (ABU), Kaduna State college of Agriculture, Kaduna State Polytechnic and Kaduna State University.

1.7 Geographical location of Our Lady of Fatima Girls Secondary School.

The study area which is Our Lady of Fatima Girls Secondary School Sabon Tasha, Kaduna (Fig.1.2a & b), is situated in Chikun local government area of Kaduna State. It is located along Kaduna-Kachia Road. It is bounded by Total filling station to the south and Nitel to the west, Chanchangi properties to the east and Sabon Tasha-Kachia Road in the north. It is situated on latitude $10^{0}26'$ and longitude $07^{0}27'$.

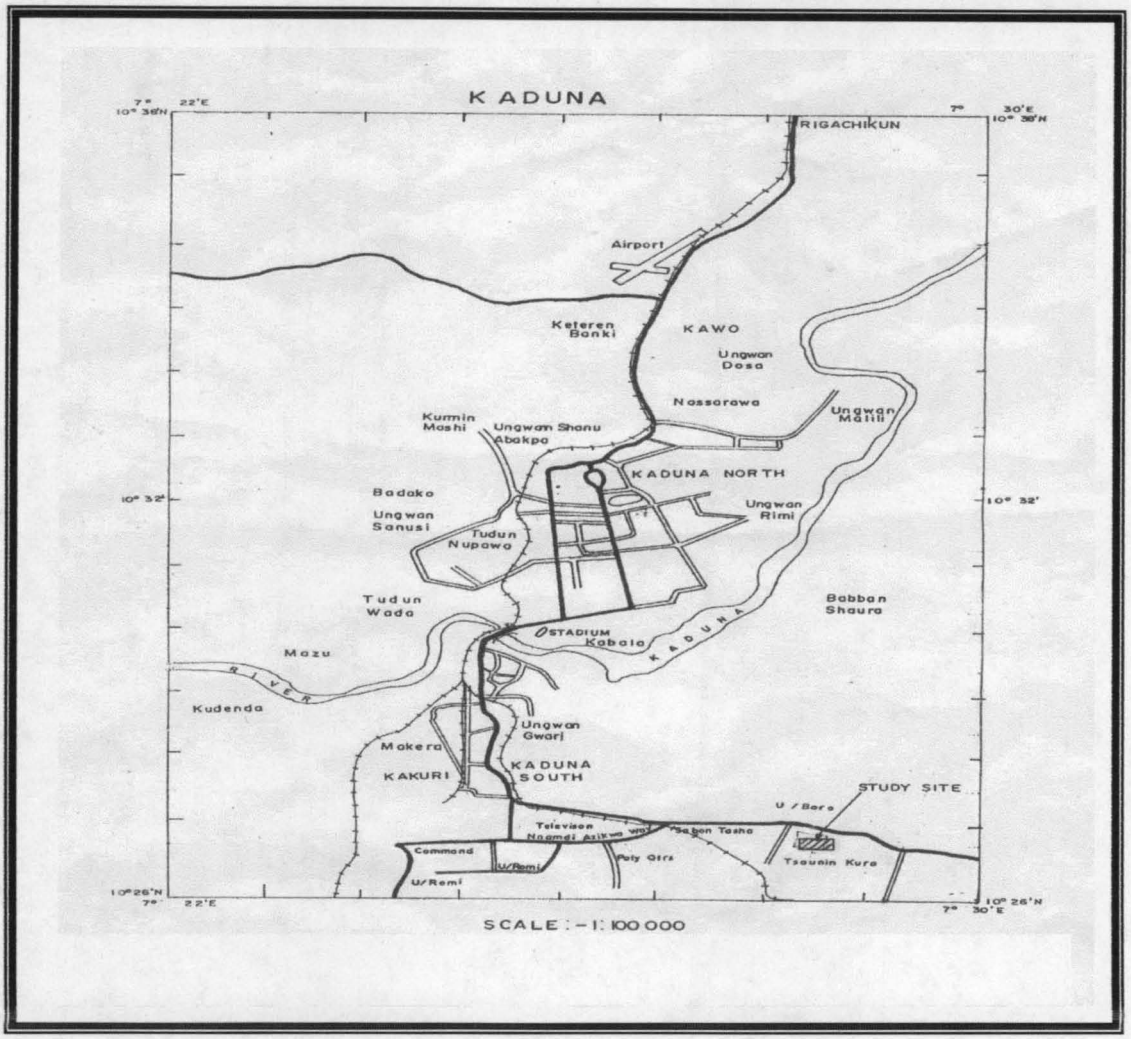


Fig.1.2a: Map of Kaduna Metropolis Showing the Location of the Study Area.

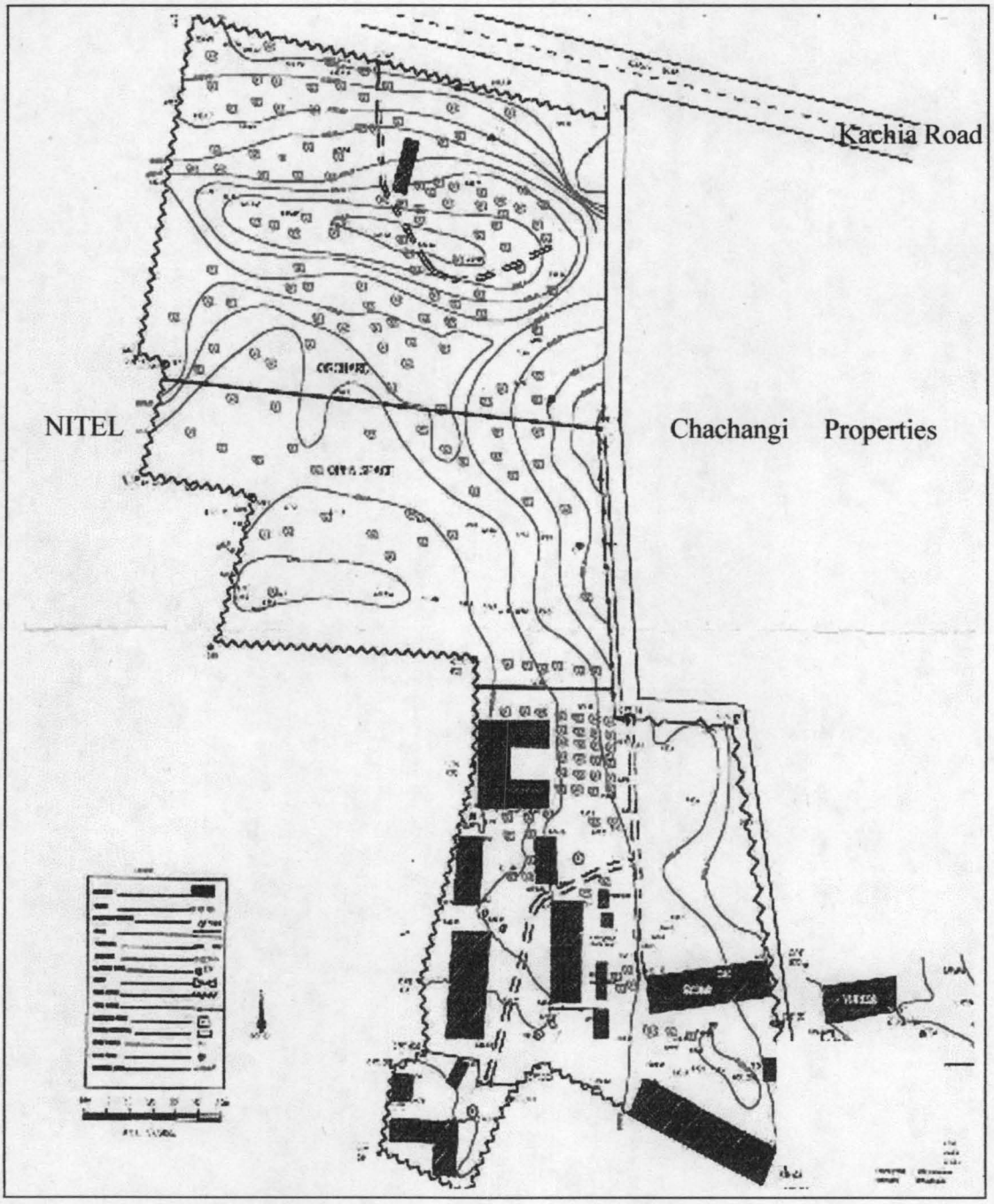


Fig 1.2b: Cadastral Map of Our Lady of Fatima Girls Secondary School, Kaduna.

1.7.1 **Brief History of the school**

Our Lady of Fatima Girls secondary School was established in the year 1990 by the Catholic Archdiocese of Kaduna for the moral and academic upbringing of young girls from different religious and ethnic groups. The school started with 85 students making up two JSS 1 classes. The school continued to increase both in population and facility. Presently the school has a student population of 583. The school celebrated the graduation of the 10^{th} set of its final year students in July, 2004. The school's academic record shows that it has maintained good academic performance over the years both in internal and external examinations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

There is hardly any aspect of human life where Geographic information system (GIS) does not hold the promise of making things better. Geographic Information System attempts to capture, store, manipulate analyse and display spatially referenced and associated tabular attribute data for solving complex research planning and management problems (Fischer and Nijkamp, 1992). GIS applications are changing the way decisions are taken. GIS has gone mainstream, migrating from mainframe and mid range platforms to desktop computers. To fully realize its potential, GIS needed high performance computing hence it has been a beneficiary of fast advancements in hardware and networks. Today, GIS is an integral part of decision making in many governments and corporations and is recognized as a powerful tool to assist decision makers.

Educational organizations can benefit from GIS applications in many ways. These include:

(a) Mapping student data by location to analyze and discover trends.

(b) Combining student or attendance data with school population data.

(c) Digitizing school facilities/blueprints to aid in resource allocation or development of emergency response plan.

(d) Creating maps, charts, and graphs for distribution via paper, e-mail, or the web.

(e) With web-enabled mapping, school attendance information can be made available to the public online thereby reducing calls to staff (Council of Government, 2002).

This chapter reviews various areas that GIS have been used for decision making.

2.2 General Overview of Databases.

Radwan (1991) views topographic database as a special type of database, capable of dealing with geographic entities, their descriptors (Spatial/positional and Attribute/functional) and the relationship (spatial and functional) among them. Database is a collection of information related by a factor purpose. It is bringing data into electronic environment for later use (Korte and George, 1993). Date (1993) defined database as basically a computerized record keeping system, with an overall purpose of maintaining information and making it available on demand. The information concerned can be anything that is deemed to be significant to the individual or organization that the system is intended to serve. In general then the data in the database at least in a large system will be both integrated and shared i.e. different users can be assessing the same piece of data/information at the same time.

Developing a GIS database is frequently thought of as simply replicating a map in a computer. GIS database involves much more than "replicating a map." While substantial portions of the GIS database will come from map source documents, many other sources may also be used, such as aerial photos, tabular files, other digital data, etc. Also, the "map" representation is only part of the GIS database. In addition to the map representation and relational tables, a GIS can hold scanned images (drawings, plans,

photos), references to other objects, names and places, and derived views from the data. The collection of data from diverse sources and its organization into a useful database requires getting the data which include acquiring existing data from both internal and external sources, evaluating and checking the source materials for completeness and quality, and/or creating new data by planning and conducting field surveys. Contemporary GIS projects attempt to rely on existing, rather than new, data due to the high cost of original data collection. However, existing data (maps and other forms) were usually created for some other purpose and thus have constraints for use in a GIS. This places much greater importance on evaluating and checking the suitability of source data for use in a GIS.

Geographic Information System (GIS) has been referred to as smart mapping because users can identify feature attributes on a map just by the click of a mouse. Behind the scenes, each feature in the map is connected to a database that stores information about that feature. For instance, one can click on a school point on a map and find out the school name, address, phone number, acreage, capacity and current enrollment (Cropper, 2004).

Infrastructures denote services and facilities, which are integral part of life such as transport, communication and shopping facilities. Most of the information relating to infrastructure is geo-referenced i.e. being referenced to a specific geographic location; therefore, the need to be mapped. Infrastructure can be evaluated in terms of physical facility and services they provide. In order to manage this infrastructure properly, there is need to know "what is where" and "where is what". It is not an end in itself but a means

to present geographic data in such a way as to be used to promote standard of living and proffer solutions to economic, social, health and related problems (Henseler, 2004).

Present day studies, emphasizes the power of GIS technology, which helps in giving better understanding and evaluation of spatial data by creating graphic display using information stored in a database. GIS does more than just display of data. It enables the user to dynamically analyze and update the information linked to those locations spatially and further strengthens electronic governance (e-governance) (Mili *et al* 2004).

2.3. **Decision and Decision-making**: Decision is something somebody has settled on i.e. something somebody chooses or makes up his or her mind about, after considering it and other possible choices. On the other hand Decision-making has to do with deciding on important matters i.e. the process of making choices or reaching conclusions on important matters. This may involve a number of individuals. In school based decision making for example the staff, parents and community are involved (School Based Decision Making) according to Jeffco Schools Brochure (2004). Clearinghouse on Educational Policy Making calls it Shared Decision Making (SDM). Allen and Carl (1992) said it involves fundamental changes in the way schools are managed and alterations in the roles and relationships of everyone in the school community. Therefore it is a process of making educational decisions in a collaborative manner at the school level. This is to increase school effectiveness (Liontos and Balster, 1993). This process is an ongoing one; SDM "cannot be done once and forgotten" (Meadows, 1990).

In a school, hundreds of decisions are made each day such as decisions that have to do with Instructional e.g. Academic activities and learning resources, Students awards

and recognition as well as enrichment activities. Others have to do with Resources e.g. Budget development and evaluation, grant writing, employee recognition, recruiting, selecting, recognizing and using volunteers. Still others have to do with Governance and Management e.g. Discipline plan, attendance policy, communication, school safety issues, scheduling and special events e.t.c.

Data helps in making changes and when you examine school data it really portrays student's achievement vividly. In the new climate of accountability and data driven decision making, data use, tools and resources need to be readily available for educators and those that support them (in using data in a classroom, school or district) to foster school improvement (Virginia, 2002).

2.4 General Application of Database for Decision-making.

The contribution and rapid advancement and innovations in the application of GIS and Geo imaging technology to planning and decision making are not only a useful visual tool but constitute an essential role in the process as Education Technology (ET) knowledge series puts it. With new tools and techniques GIS has moved beyond traditional application in areas like transportation, management of natural resources, monitoring of environment, social services, agriculture, revenue, readiness for emergencies and economic development. More specifically GIS today is a tool to expedite analysis of census data (in terms of demographics), investigate impacts of pesticides, improve assessment of tax, examine trends in crime and manage minerals. The private sector now utilizes GIS to find sites for new restaurants or retail outlets to route utility lines, identify providers of medical care and manage election campaigns. The other areas include planning landuse; local government mapping, military, risk management,

crime prevention and detection, health care and many more. It acts as an infrastructure base for building on top of other information for various perspectives. Examples are numerous on utilizing GIS for planning purposes such as GIS and multi-criteria analysis for land management (Joerin *et al* 1998 and 2001), towards flexible GIS user interfaces for creative engineering (Golay *et al* 2000), system integration of GIS and rule based expert system for urban planning (Choi and Usery, 2004).

Other works are more focused on the rate of using geospatial information as a base infrastructure for designing a GIS based computer collaborative system for urban planning (Cheng *et al* 2004). It is in fact a current trend in modern organization towards flatter structures and the involvement of many stakeholder groups in solving problems on what can be called spatial decision support system (Jankowski *et al* 1997). On the other hand one has to decide on the role and limits as well as development of using institutionalize GIS and Geo imagery in planning and decision support system (Golay and Major, 2000).

Ranchi district in India was taken as a case study for Spatial Decision Support System (SDSS) using GIS based infrastructure planning in health to provide planners with accurate spatial view of the district at different levels. Different demographic data as well as health related data and to assist the planners in finding out the possible locations for health centers depending on several parameters such as population density, number of health centers required and its optimum location, number of disease infected persons etc. The SDSS was effective and satisfied the stated objectives in the field of health (Mili *et al* 2004).

The use of environmental GIS in the CORINE programmes was implemented and successful. This was to rationalize data collection and availability and develop appropriate techniques for its storage and manipulation. The information covers themes such as water resources and quality, atmospheric pollutants, slopes and erosion risks, administrative units and basic socio economic data. (Wyatt *et al* 1988).

A demonstration of the use of GIS was also carried out in the design and creation of geospatial database for Engineers Survey Regiment Owode-Yelwa, Ogun State, Nigeria. The database was required for the production of maps for the Nigerian Army as it lacks a common documentation of its resources and land features in digital form. This was achieved through the use of a topographical map of the study area which was digitized and the attributes obtained from map and office records (Kehinde, 1999).

2.5 **Application of Database for school Decision-making.**

The trend towards using GIS and school mapping to support decision making for Ministries of Education in the world is becoming very important for planning purposes and is in the implementation stage in many leading countries of the world and in the developing countries [(Rice *et al*, 2001; Makino and Watanabe, 2002; Al-Hanbali, 2003). Rice *et al* (2001) in a workshop conducted for Department for International Development (DFID) looked into the contribution of infrastructure and planning to educational strategies. School mapping constituted a major chapter. School mapping is the art and science of building geospatial databases with relational databases of educational, demographic, social and economic information for schools and educational directorates to support planners and decision makers. Their results show that in order to do proper

planning the educational sector should not start any project before making available to all involved parties a comprehensive database of all schools, pupils, teachers and resources. Building that part of GIS layers with showing school locations and other significant geographic features such as streets, railroads, city zoning, school directorates, district governorates and other features would provide an excellent tool for planners.

Makino and Watanabe (2000) worked on collection of available non-spatial school related data from all the ministries and Bangkok Metropolitan Authority (BMA) to develop database integrated into GIS data to analyze the current school distribution. From the findings of their study, the current haphazard school allocation could be interpreted easily by GIS analyses. The application of GIS to the school mapping was useful in finding the appropriate sites for locating new school buildings efficiently and rationally. With this it will be easier to provide inexpensive public schools in every village which is of great importance particularly in developing countries where the correlation between the adults with higher level of educational attainment and individual earnings, employment opportunity in the urban labour markets and agricultural productivity is significantly positive. Education affects development through various dimensions of cognitive competence e.g. in areas like literacy (reading and writing), numeric, modernity and problem solving behaviours (Lockheed and Verspoor, 1990). Therefore, the need to spread these public schools.

In Jordan school mapping was utilized to approve the proposal of Education Reform for the Knowledge Economy (ERfKE proposal 2002) for constructing new schools as well as renovating existing schools. Ranchi district in India developed a Spatial Decision Support System (SDSS) using GIS based infrastructure for planning

education to assist planners with educational related data as well as an accurate spatial view of the district and detailed demographic data. This will assist the planners in finding out possible locations for the schools depending on several parameters such as percentage of literates, number of primary schools and middle schools required and its optimum location, number of teachers posted, vacancy and requirement as per norms etc in a village. The SDSS was effective and satisfied the stated objectives in the field of Education. The village and block level maps showing several demographic related data along with current status of education will aid the government for better governance. If all or most of the state departments join hands in a combined effort to implement GIS based system, then it will be a big leap towards e-governance for a new state like Jharkhand. However, the SDSS can be amplified much more by incorporating Remote Sensing and GPS technology. Also to make it more comprehensive, more and more data from all departments where computerization is in progress can be integrated at village/block level (Mili *et al* 2004).

Cropper (2004) in his work on GIS in school facility planning agreed with the fact that GIS has proven to be an excellent tool in school planning process. Recently, Dejong and associates Inc. used GIS to help develop school facilities master plans for six largest urban districts in Ohio, including Akron, Columbus, Cincinnati, Dayton, Toledo and Cleveland. The result showed that not only does GIS help to make more accurate decisions, but that all decisions can be made in a fraction of time. GIS help in student and demographic analysis; it is also essential when performing feasibility studies. GIS allow planners and administrators to spatially analyze student population in the district. For instance one can analyze where students are living in relation to the school they are

attending, color-coding students to see how the students are dispersed throughout the district. One could determine if the enrollment is right for that particular school. For example if the majority of the student's population is far away from the school then the concern might be raised that the current site is not the best location for the current enrollment. He also added that demographic analysis could be utilized much more effectively with the use of GIS. Having the ability to map out birth, housing and demolition permits enable the district to see where growth and decline is occurring. This data can be overlaid on top of the attendance boundaries so planners can pin point which schools will be imparted the most by apparent growth or decline. The ability to link school districts and other area databases to a map have proved to be an invaluable tool in the overall planning process. By utilizing GIS, Student databases, school points, attendance areas, bus routes and many additional layers can be displayed and analyzed on a map. The ability to integrate all data used in planning into one system and to analyze spatial relationship has proven to make the whole process much more accurate and efficient.

A team of academic and public first responders have developed and deployed a large scale, small area nested geospatial dataset with access applications for security management in a metropolitan school district. The information compiled to implement this GIS application ranged from dataset of an entire metropolitan area to large scale datasets of object location within a particular space. The large-scale data can convey the relationship between a window door and closet within a classroom while referencing the macro scale of the entire school district dataset. The small-scale attributes of the system allow for a relationship to be established between a particular and the others within the

district. The compilation of this various elements addressed the crises information management needs of first responders. This came up as a result of the dramatic increase in violence in schools (Carey and Garry, 2003).

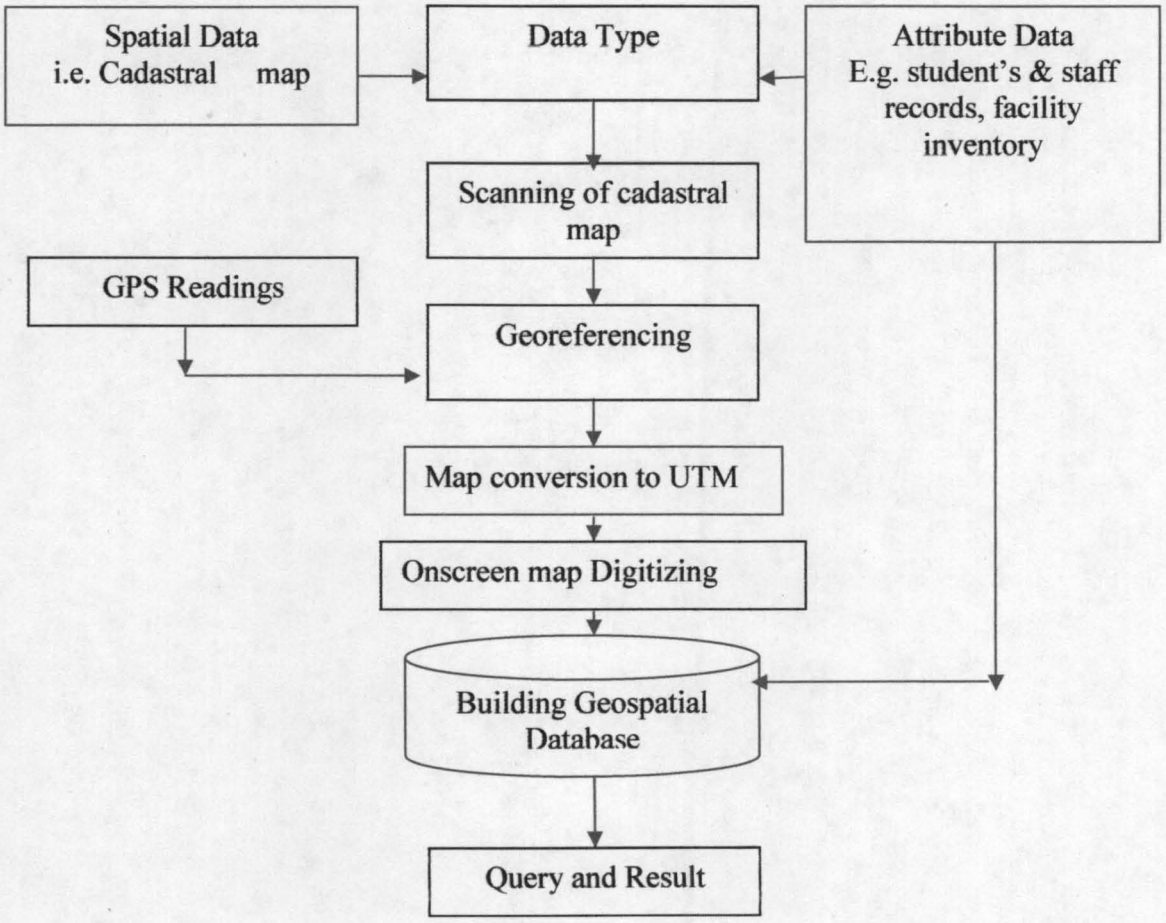
This go a long way in showing that in recent years, there have been noteworthy changes in the types and successes of GIS implementation. According to Sauer and Carl (1940) and Korte (2001), creating a point positional perspective with the concept of location as its organizational principle is obviously suited or limited to application and management of specific types of data with particular structures, missions and uses.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The materials used in conducting this research work are discussed in this chapter as well as the description of the materials and the methods used in carrying out the work. The schematic diagram of the research methodology is also represented (Figure 3.1).



Source: Author's Work, 2005

Fig. 3.1: Schedule of Work

3.2 Materials used

The list of materials used for this research is grouped into three. This include: the base map, hardware and the software used.

3.2.1 Base Map

The cadastral maps of the study area were acquired at the scale of 1: 500 and 1: 2500 (with vertical interval of 0.5m) from the college of environmental studies Kaduna Polytechnic.

3.2.2 Hardware

I. **Scanner**

An A3 size scanner was used to convert maps and photographs into digital data for processing in computer. The main component of a scanner is a sensor, which systematically scans the document in parallel lines. Each element (pixel) has its reflectance value and the amount of reflected and/or transmitted light is recorded. The scanning was done using Corel photo paint 10 and saved in JPEG Bitmap format. The JPEG images were copied to hard disk and saved in Tagged image format (TIFF) for georeferencing in ILWIS.

II. **A mini-computer**

This was used for analysis, manipulation, storage, display and retrieval of data.

III. **Global Positioning System (GPS) receiver**

For recording control points required to georeference the map. The points used are tabulated in table 3.1. It was also used to pick the coordinates of the new building for updating the map.

IV. **Printer:** for printing on paper the outcome of the research.

3.2.3 Software

In GIS different software and formats are applied to achieve good results. GIS software has certain limitation in function/operation. For example ILWIS mainly work with raster and only support vector operation while ArcView is better with vector and only supports raster.

Since, this work is mostly in vector form, ILWIS 3.2 academic was used to georeference the scanned cadastral map of the school i.e. transforming the coordinates of the surfaces to the same coordinate system [Universal transverse Mercator (UTM)]. ILWIS accepts TIFF image therefore direct importation of the scanned map was possible. ArcView 3.2a was used as the GIS software for processing and visualization of the database developed for better results.

3.3 Method of Data Collection

3.3.1 Oral interview

Oral interview was conducted with the school management staff in order to generate information about the problems and complaints being faced in the school and the decisions often being taken. Some decisions are taken daily, some weekly while others can be per term or session.

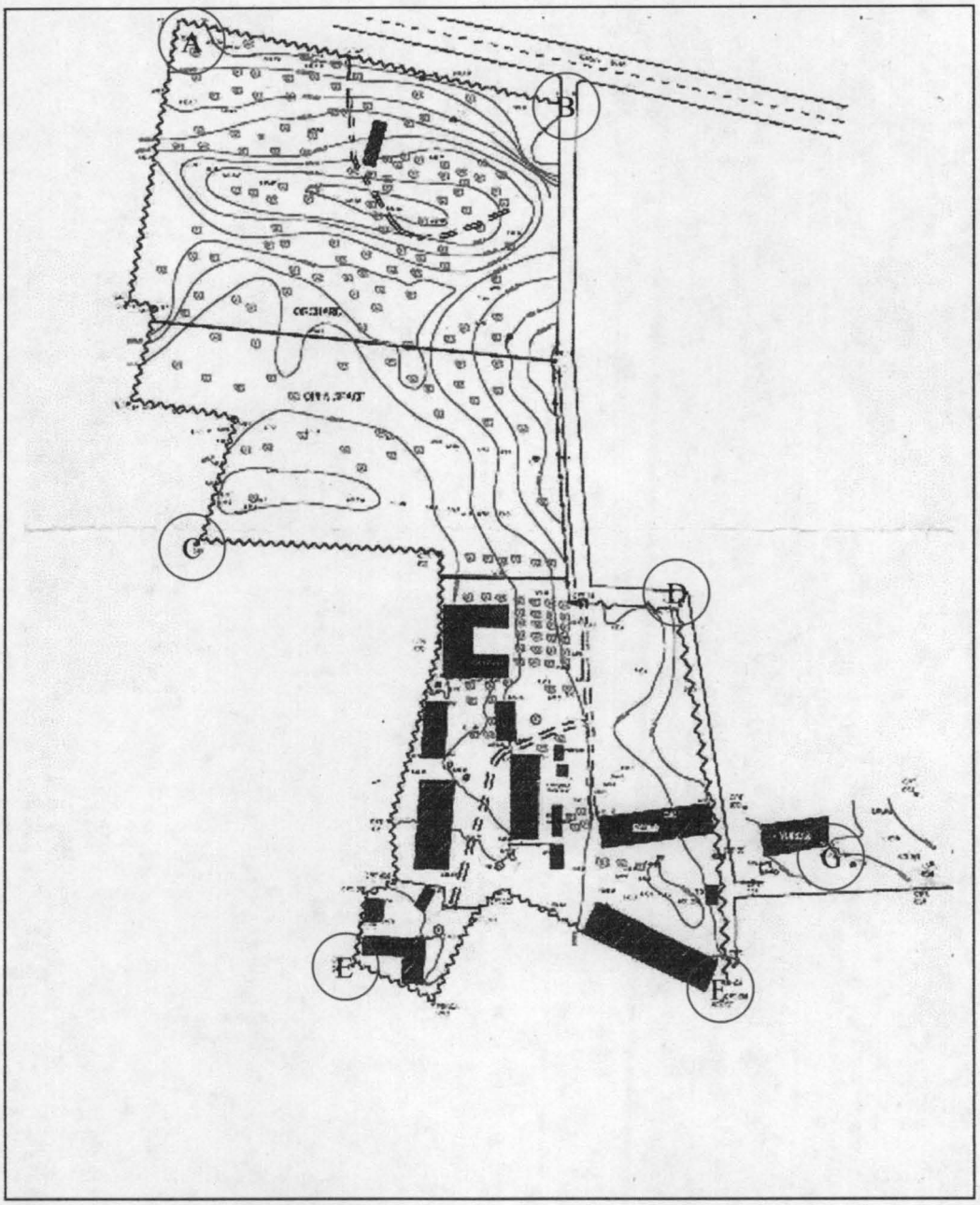
3.3.2 **Reconnaissance Survey**

A reconnaissance survey was carried out round the school compound and surroundings to ascertain the present position and condition of facilities as well as services and existing potential landscape features in the school. Cross section photographs of facilities as shown in Figure 4.2 as well as GPS readings of chosen control points were taken as shown in Table 3.1 and Fig 3.2.

Table 3.1: **GPS readings and control points taken for Map Georeference**

S/n	Control points	X(Northing)	Y(Easting)
1	A	332350	1155450
2	B	332600	1155419
3	C	332368	1155179
4	D	332616	1155146
5	E	332439	1154970
6	F	332615	1154956
7	G	332672	1155019

Source: Field work, 2005.



Source: Field work, 2005.

Fig. 3.2: Cadastral map showing the control points used for georeferencing.

3.3.3 Secondary data

For a comprehensive GIS database to be developed for this study, data (secondary) was obtained from various concerned departments. Data such as students and staff records, facilities inventories and maps were obtained from the school. Other information for various subjects' e.g. scores and performances were explored. Both published and unpublished materials such as journals, seminar, internet, official publications, handbooks, bills, pamphlets etc were used for literature and concepts for better analysis and result.

3.4 Data Description

Two types of data set were collected for the purpose of this research. They include:

1 Vector based data in the form of analogue map, and

2 Attribute data

3.4.1 Vector based data

The cadastral maps of the study area were acquired at the scale of 1:2500 and 1:500(with vertical interval of 0.5m) from the college of environmental studies Kaduna Polytechnic. The cadastral map contain information such as, roads, trees and the school building layout: the classroom blocks, laboratories, library, school hall, student's hostel, school farm and staff quarters. This would serve as geospatial information required for the development of the GIS database.

3.4.2 **Attribute data**

Attribute data set collected for this research were divided into two sub categories: primary attribute data generated for geographic analysis and the attribute data generated from secondary sources. Primary attribute data are those obtained through field observation which had to do with the existing facilities and services. On the other hand attribute data from secondary sources include interviews with the school management board and school hand book and records. This information includes the staff information, student records, problems and complaints from staff, students and parents and the types of decisions often being faced.

3.5 **GIS Database Development**

3.5.1 **Map Creation**

Map is one of the common products of GIS. Maps are generally easy to make in GIS and they are often the most effective means of communicating the results of the GIS process. Therefore, the GIS are usually a prolific producer of maps. In this project, maps of various facilities with user friendly legends can be created to aid in the decision making, planning and delivering of educational services in our schools (Fig.4.1).

3.5.1.1 **Map Scanning and Digitization**

The 1:2500 scaled cadastral analogue map of the school layout showing the existing school facilities were scanned and georeferenced using ILWIS 3.2 Software. ArcView 3.2a GIS software was used for the on screen digitizing of the map features into classified themes as shown in Fig.4.1. The digitized map was edited. During the process of editing, edge matching errors, feature duplication errors and all other errors associated

with the map were identified and eliminated. The entire system was then edited to ensure that the data were correctly entered.

3.5.2. **Database**

The attribute data such as the names of staff students records, inventory of school laboratories/hostels, computer room and library among others were entered into attribute tables and linked to their spatial data and photographs taken (hot linked) i.e. integrating the spatial and non spatial data. GIS allows the linkage of spatial and non-spatial data based upon a defined relationship. A one to one relationship can be defined for each of the spatial entity with the non-spatial data. Hot links (Fig.4.3) were set up between different views, images, so that, for example, clinking on a particular facility in a view showing the map of the school, can automatically display another view showing detailed information about that particular facility condition in the school.

3.5.3. **Database Implementation**

The databases corresponding to the various theme earlier created in the system were implemented. Each theme has attribute data which are entered into the attribute table. Other related information that would be necessary in generating result in school decision making were entered. The database is made up of the following information: Students name, subjects offered, exam results, school facilities, structural capacity of the existing buildings, staff population and qualification as well as students per subjects, roads and water supply.

With a good GIS database design a summary report (Fig.4.11) can be generated depending on the nature of information that is required for decision making from the GIS software(Arc View 3.2a) using Quick Report, Cross Tab and a report based on another template module.

Quick Report provides the ability to create simple tabular reports based on the information available in database. All that is required is to select what fields to use and change margins, fonts, column widths, and column heights. Quick Reports can be printed, exported to other formats but can not be saved as templates for later use.

Cross Tab Provides the ability to create reports which cross-reference data from Arc View to data stored in other databases. A cross tab report summarizes data and presents it in a compact row column format making it easy to analyze the data.

A report based on another template provides the ability to use a previously created report as the template for a new report. If you previously created a report for the same table but it included a different set of records, you can use this option to create a report with the same layout and design but with a new selection of records. In this work a summary of student's performance in mathematics is being illustrated (Fig. 4.11)

3.5.4. **Map Updating**

Maps keep changing as a result of population increase and development projects. With this regular updating of maps become very essential. Map update can be done as soon as there is a change using GIS. This is applicable to both spatial and attributes data.

In the course of this research work a new building (dinning hall) was set up. The GPS points where taken and used for updating the school map to give the present situation using Arc view 3.2 academic.

3.6. **Query: Database Result**

Fundamental to all information systems whether geographical or otherwise is the need to search through a quantity of data that is often very large in order to find a subset which satisfies the users query. The distinguishing characteristic of typical geographical data retrieval is that it is expressed in terms of spatial location and spatial relationships (Jones, 1997)

Queries were performed on the information system using ArcView3.2a query builder to get information about features. Query can be done in a variety of ways. It allows the viewing of both spatial and tabular results captured together in the test figure corresponding to each query as shown in Fig.4.8. The distinguishing characteristic of the typical geographical data retrieval is that it is expressed in terms of spatial location and spatial relationships. In general queries may be either location based or phenomenon based or a combination of the two. A location based query specifies a location and asks what phenomena are to be found there while a phenomenon based query specifies particular phenomena and asks where they are to be found (Jones 1997).

Query cells were generated using query builder, based on precise query expressions which will provide the administrator and planner necessary information by clicking on some buttons. These query expressions can be grouped into several classes such as simple query expression, only by mathematical (=, +,-…) or relational operator (<,>,>=) is used whereas in compound query expression, logical ("AND","OR".)

operators are used along with mathematical and relation operator. In this context, for example, a query performed by a form mistress to assess the student's performance by subject and to determine the overall best performed student in the class.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

4.1 Introduction

Rapid advancement and innovations in the application of Geographic Information Systems (GIS) to planning and decision making is not only a useful visual tool, but it constitutes an essential role in the process. It acts as the infrastructure base for building on top other information from various perspectives.

The trend towards using GIS and school mapping to support decision making for Ministries of Education in the world is becoming very important for planning purposes and is in the implementation stages in many leading countries of the world, and in the development countries (Rice *et al*, 2001). Building a geospatial database and using GIS is becoming a standard and a requirement for funding agencies to approve loans and grants, such as World Bank (DFID) and US Aid. School mapping is the art and science of building geospatial database with relational database of educational, demographic, social and economic information for schools and educational directorates to support educational informational planners and decision makers.

In the life of a school, hundreds of decisions are made. Some decisions come as emergencies and must be made immediately by the principal. Other decisions may involve the staff. Still other decisions involve staff and parents working in a collaborative group. Irrespective of the decision that may be required by the school, a comprehensive GIS database serves as an analytical tool for planning and decision making.

This project therefore, is designed to demonstrate the importance and need for development of geospatial database for school decision making using Our Lady of Fatima Girls Secondary School, Sabon Tasha Kaduna as a case study. The outputs of the database are reported below:

4.2 GIS Database Results and Decision Making

There is an inherently spatial component to many aspects of delivering Educational Services in public or private education. Incorporating GIS into the delivery of these activities provides a significant analytical tool for planning, presenting pattern detection, conducting analysis, and conveying information to the public or decision makers. Geographic Information System (GIS) technology can provide a significant analytical tool for planning and delivering educational services in public or private education. Below is the map of the school (Fig 4.1) showing its boundary, buildings, roads e.t.c. This gives decision makers full view of the school e.g. the position of buildings and their distance one from the other, developed and undeveloped areas etc. Decisions on ideal positions of classrooms in relation to other buildings can be tackled easily and enhanced while inadequate ones can also be corrected without having to go round the school in order to see what is obtainable. The map is quite explicit as the legend tells what the feature is and for more information on a particular feature, the feature can be clicked for details. This conforms to the findings of Cropper (2004) that GIS is referred to as smart mapping because users can identify feature attributes on a map

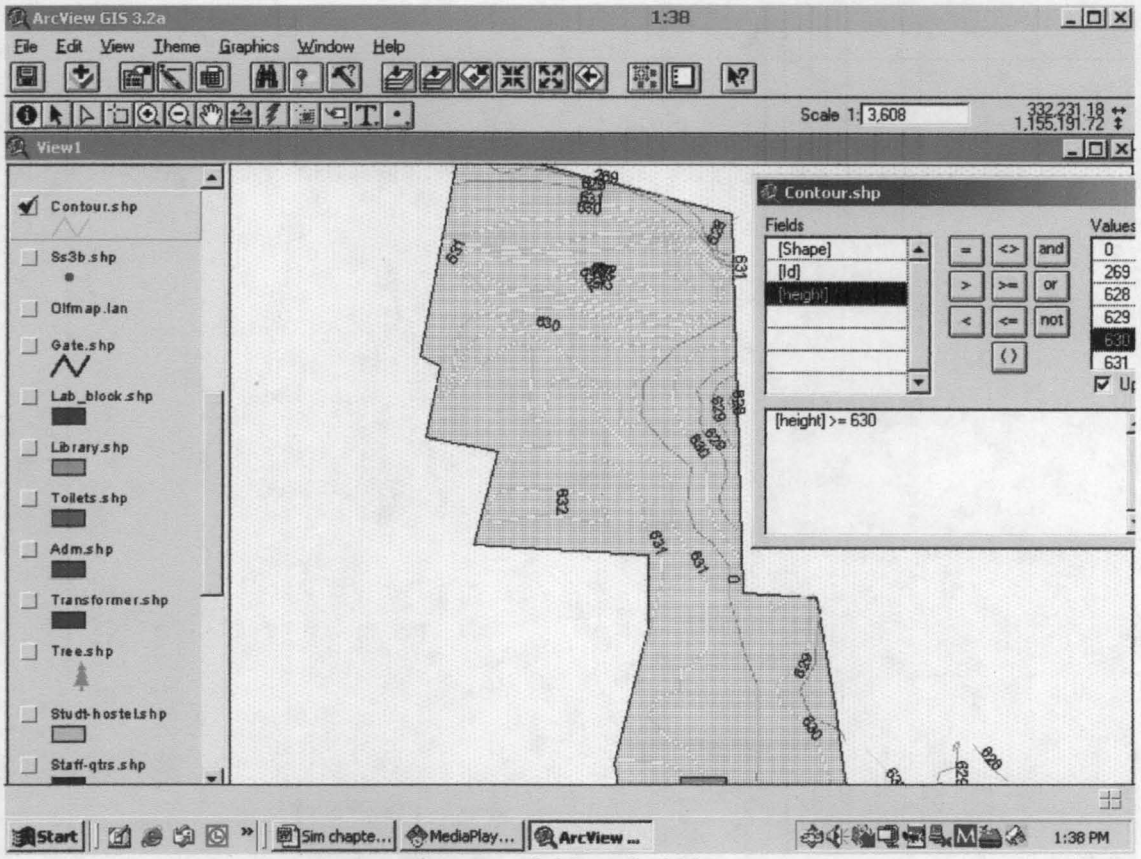
just by a click of a mouse and behind the scenes; each feature on the map is connected to a database that stores information about that feature.

Source: Field work, 2005.

Fig.4.1: Map of the school showing the full view.

Another advantage is that GIS map can be viewed layer by layer such that what you desire is what you call for. Ehlers (1997) GIS is designed to accept large volume of spatial data derived from variety of sources for use according to user designed specifications. For instance, if you are working with the road network you can concentrate just on that or the built up area or the boundary or the school topography.

This is illustrated in Fig. 4.2 below showing the contour layer of the school which can be used to find out the topography of the school. Clicking on the contours using the identifier button will give the contour value of each contour.



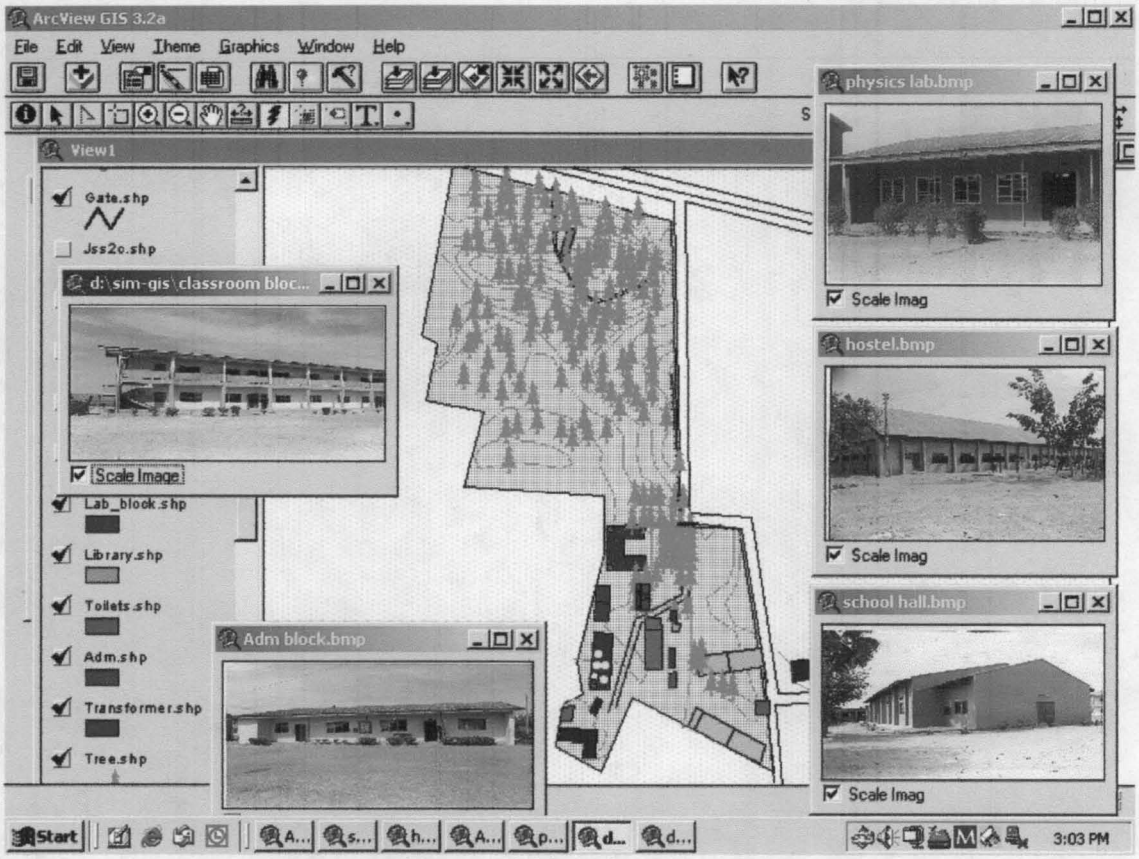
Source: Field work, 2005.

Fig. 4.2: Map of Our Lady of Fatima Girls Secondary School showing the contour layer.

4.3 **Hot link**

Pictures and images of various facilities can be used for hot link. Since a building for example can not be presented on a map as it is. Hot link makes it possible for decision makers to view the facilities as they exist on ground depending on need. Pictures can be

taken both inside and outside the school compound and buildings. This is then used to link to the represented feature on the map.



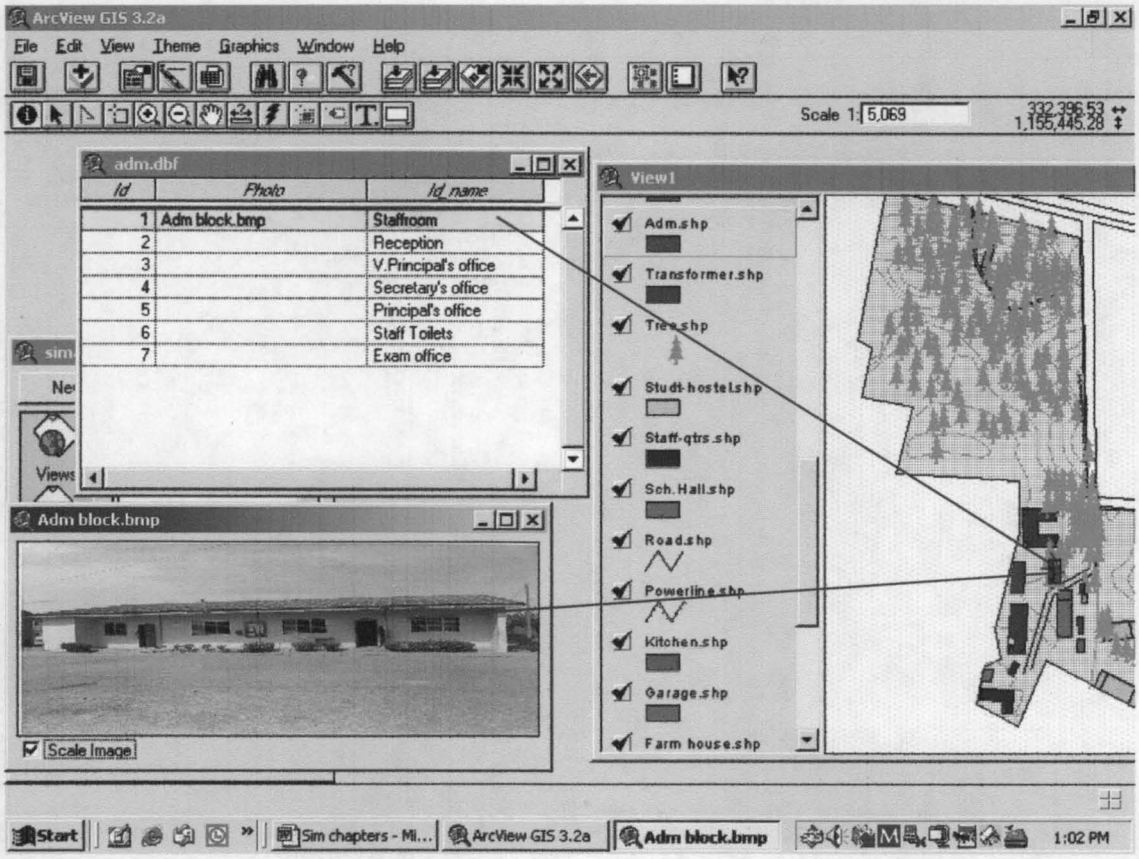
Source: Field work, 2005

Fig.4.3: Hot linked views and images

4.4 Linkage of Spatial and Non -Spatial Data

With GIS database Spatial and non spatial data can be viewed at the same time. This is useful in decision making as situations can be seen easily. In this research work, such is being illustrated in the figure below (Fig. 4.4) where the position of the staffroom is shown on the map as well as the information on the different offices in the block. Staff (occupants) records can also be viewed when there is need for further details. Such information includes names of staff, their qualifications, teaching subjects and other

responsibilities as shown in Table 4.1. This agrees with Fryrear *et al (*2002) that the use of GIS applications provides a visual understanding of data previously analysed using spreadsheets and this visual aspect helps determine relationships in data that were not obvious in spreadsheet form.

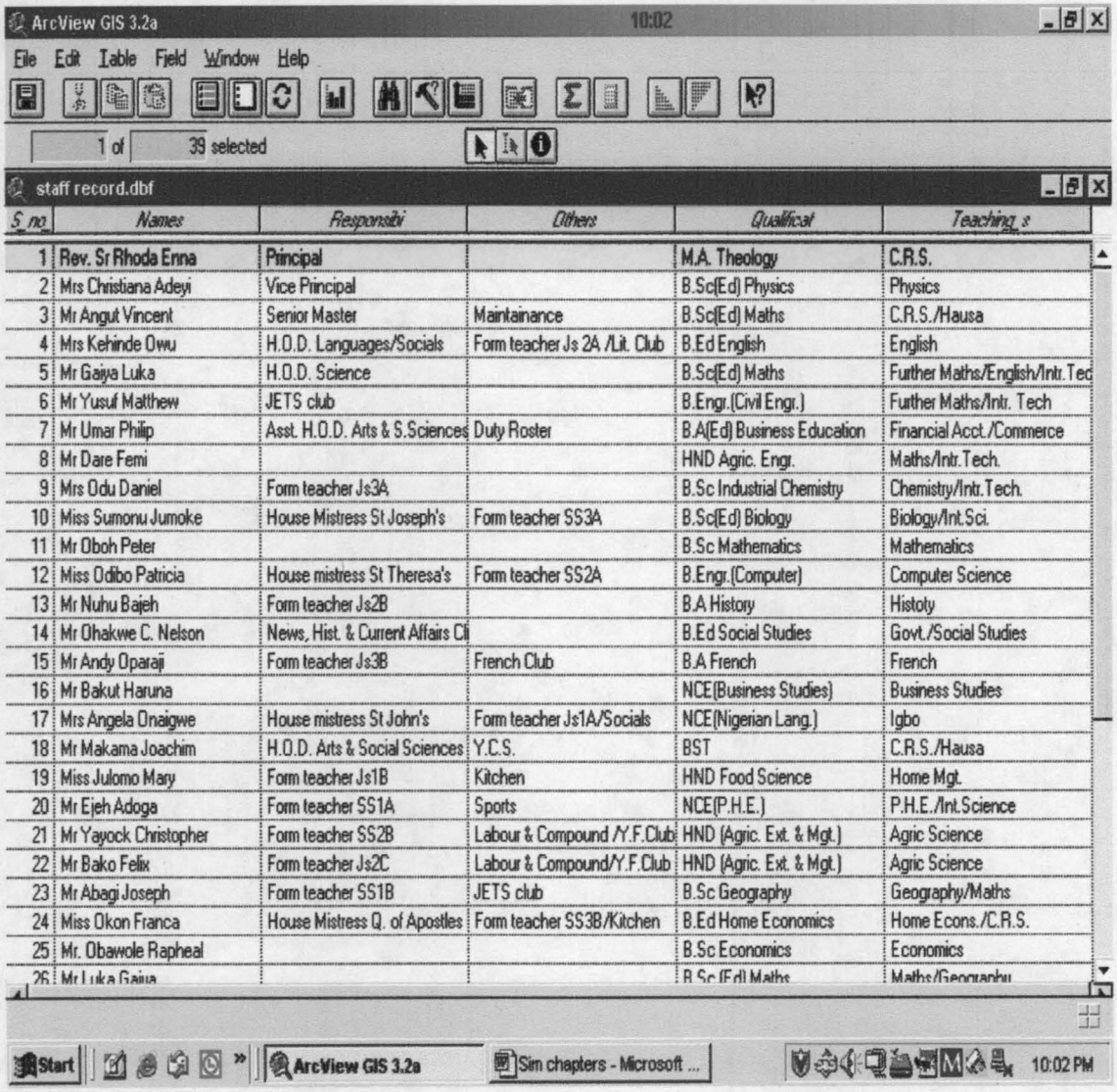


Source: Field work, 2005

Fig 4.4: Linkage of spatial and Non Spatial data

This will help in taking decisions on staff recruitment and retrenchment because the subject areas being understaffed can easily be identified as well as those over staffed if any. The number of teachers available to students per subject can also be seen clearly.

Table 4.1: Staff Record.



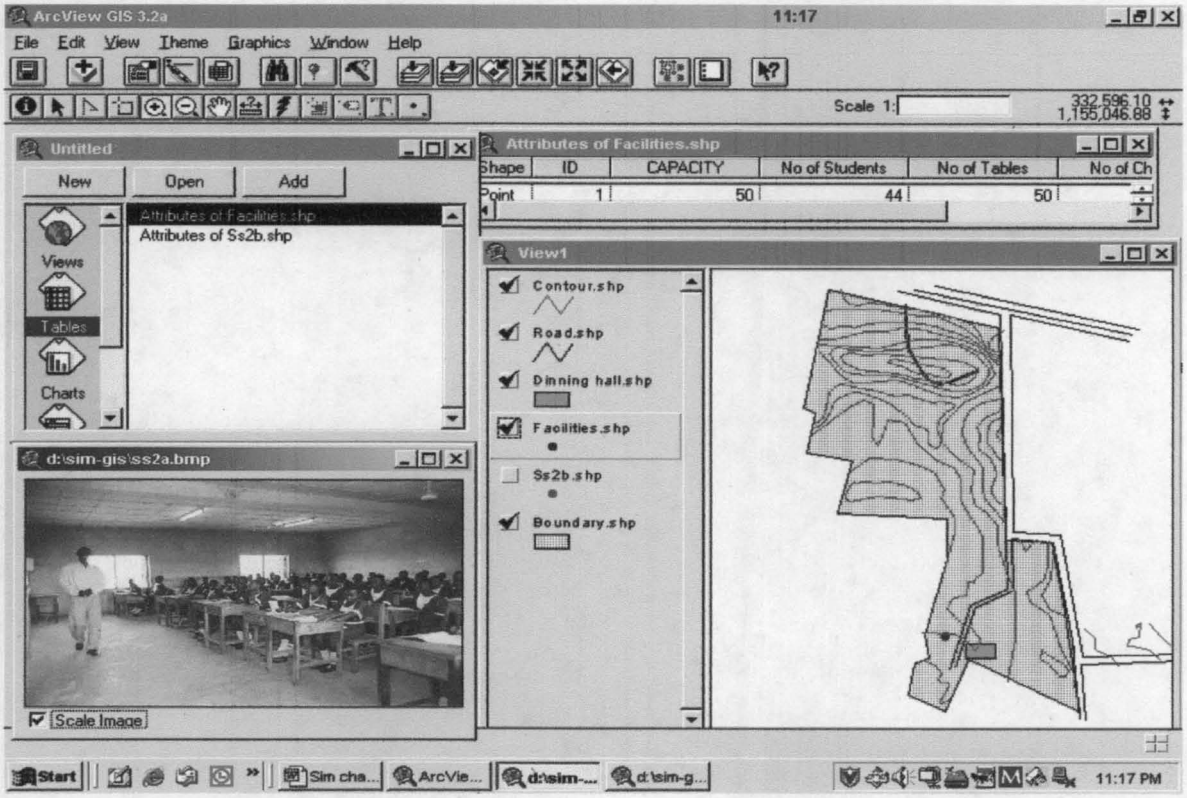
S_no	Names	Responsibi	Others	Qualificat	Teaching_s
1	Rev. Sr Rhoda Enna	Principal		M.A. Theology	C.R.S.
2	Mrs Christiana Adeyi	Vice Principal		B.Sc(Ed) Physics	Physics
3	Mr Angut Vincent	Senior Master	Maintainance	B.Sc(Ed) Maths	C.R.S./Hausa
4	Mrs Kehinde Owu	H.O.D. Languages/Socials	Form teacher Js 2A /Lit. Club	B.Ed English	English
5	Mr Gaiya Luka	H.O.D. Science		B.Sc(Ed) Maths	Further Maths/English/Intr.Tec
6	Mr Yusuf Matthew	JETS club		B.Engr.(Civil Engr.)	Further Maths/Intr. Tech
7	Mr Umar Philip	Asst. H.O.D. Arts & S.Sciences	Duty Roster	B.A(Ed) Business Education	Financial Acct./Commerce
8	Mr Dare Femi			HND Agric. Engr.	Maths/Intr.Tech.
9	Mrs Odu Daniel	Form teacher Js3A		B.Sc Industrial Chemistry	Chemistry/Intr.Tech.
10	Miss Sumonu Jumoke	House Mistress St Joseph's	Form teacher SS3A	B.Sc(Ed) Biology	Biology/Int.Sci.
11	Mr Oboh Peter			B.Sc Mathematics	Mathematics
12	Miss Odibo Patricia	House mistress St Theresa's	Form teacher SS2A	B.Engr.(Computer)	Computer Science
13	Mr Nuhu Bajeh	Form teacher Js2B		B.A History	Histoty
14	Mr Ohakwe C. Nelson	News, Hist. & Current Affairs Cl		B.Ed Social Studies	Govt./Social Studies
15	Mr Andy Oparaji	Form teacher Js3B	French Club	B.A French	French
16	Mr Bakut Haruna			NCE(Business Studies)	Business Studies
17	Mrs Angela Onaigwe	House mistress St John's	Form teacher Js1A/Socials	NCE(Nigerian Lang.)	Igbo
18	Mr Makama Joachim	H.O.D. Arts & Social Sciences	Y.C.S.	BST	C.R.S./Hausa
19	Miss Julomo Mary	Form teacher Js1B	Kitchen	HND Food Science	Home Mgt.
20	Mr Ejeh Adoga	Form teacher SS1A	Sports	NCE(P.H.E.)	P.H.E./Int.Science
21	Mr Yayock Christopher	Form teacher SS2B	Labour & Compound /Y.F.Club	HND (Agric. Ext. & Mgt.)	Agric Science
22	Mr Bako Felix	Form teacher Js2C	Labour & Compound/Y.F.Club	HND (Agric. Ext. & Mgt.)	Agric Science
23	Mr Abagi Joseph	Form teacher SS1B	JETS club	B.Sc Geography	Geography/Maths
24	Miss Okon Franca	House Mistress Q. of Apostles	Form teacher SS3B/Kitchen	B.Ed Home Economics	Home Econs./C.R.S.
25	Mr. Obawole Rapheal			B.Sc Economics	Economics
26	Mr Luka Gaiya			B.Sc (Ed) Maths	Maths/Geography

Source: Field work, 2005

Other areas to benefit from availability of this information are issues of nomination for additional responsibilities. This can easily be tackled based on different criteria since detailed information on each staff is stored in the database. The database will also help in spreading out such responsibilities so that few individuals will not be over worked while others are idle. For example when delegating staff for workshops and seminars, it will be

easy to make it in such a way that different members of staff go out. Unlike times when it was done manually and at random where few staff are being delegated while others may even be shying away from such responsibilities and getting away with it.

Cases of vacancies and over crowding in classes for example can be illustrated using this method as photographs can be taken and hot linked showing students population per class according to their sitting arrangement (Fig. 4.5).



Source: Field work, 2005

Figure 4.5: Inventory of classroom facility.

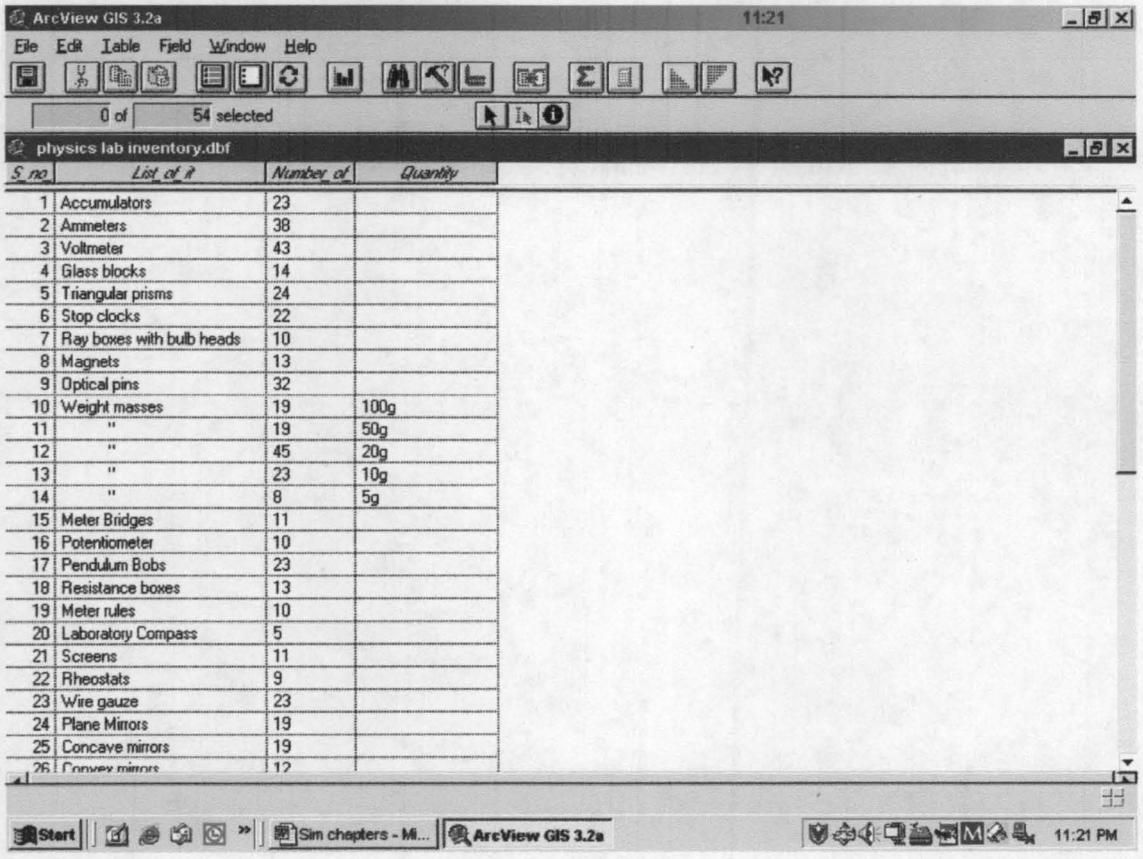
This will give parents a better view of situations being discussed when for example the school seeks assistance of the Parent Teachers Association for more classrooms, desks and chairs. It can also be that the parent intends withdrawing his/her ward from the

school complaining that their classrooms are congested. With GIS if the complain is wrong all the principal needs to do is to show the parent the detail information of that particular class giving its capacity, number of desks and chairs as well as the number of students as shown in Fig 4.5 above.

4.5 Facility inventory

An inventory of various departments in the school was taken such as the school laboratories, library and hostels and their detail information entered to be used by decision makers. The physics laboratory is being used here for illustration (Table 4.2).

Table 4.2: Inventory of Physics Laboratory Facility



S_no	List_of_it	Number_of	Quantity
1	Accumulators	23	
2	Ammeters	38	
3	Voltmeter	43	
4	Glass blocks	14	
5	Triangular prisms	24	
6	Stop clocks	22	
7	Ray boxes with bulb heads	10	
8	Magnets	13	
9	Optical pins	32	
10	Weight masses	19	100g
11	"	19	50g
12	"	45	20g
13	"	23	10g
14	"	8	5g
15	Meter Bridges	11	
16	Potentiometer	10	
17	Pendulum Bobs	23	
18	Resistance boxes	13	
19	Meter rules	10	
20	Laboratory Compass	5	
21	Screens	11	
22	Rheostats	9	
23	Wire gauze	23	
24	Plane Mirrors	19	
25	Concave mirrors	19	
26	Convex mirrors	12	

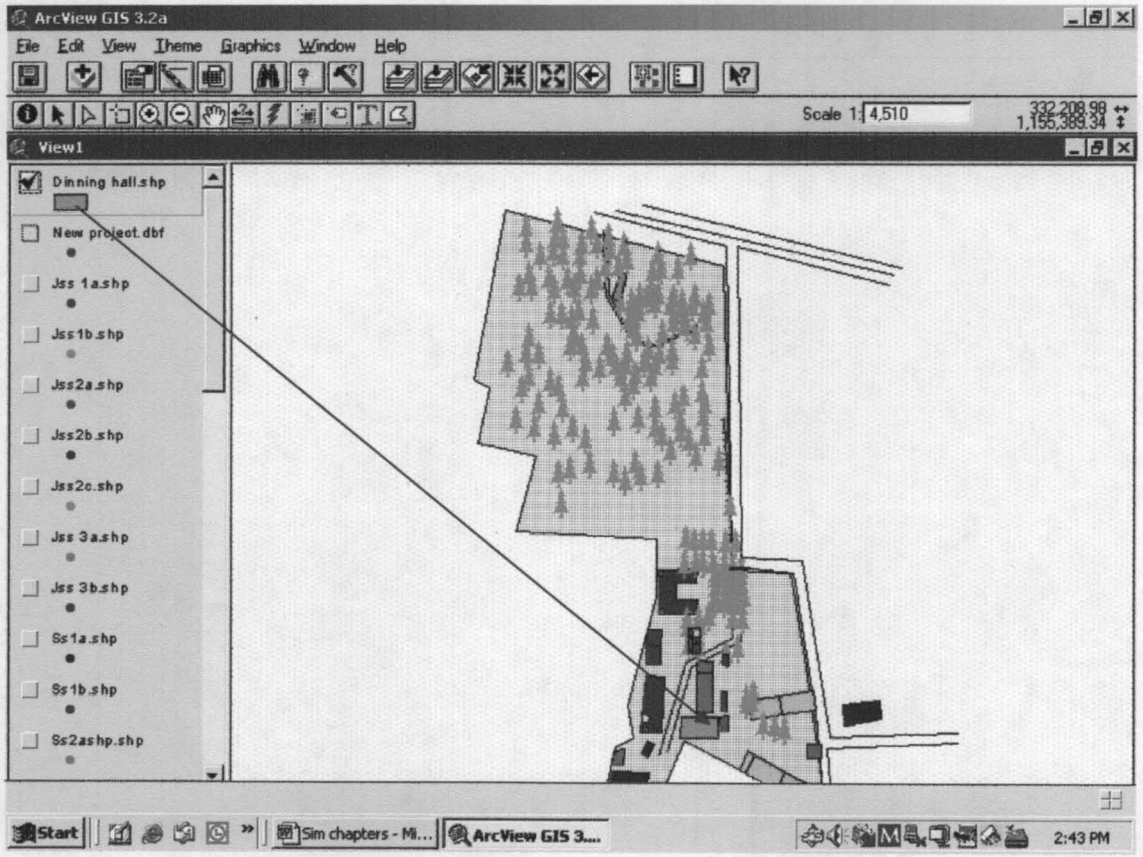
Source: Field work, 2005

With this it is easy to know the instruments and materials available for practical lessons as well as internal and external examinations e.t.c. It is more effective with GIS because of its provision for constant updating. In providing more facilities for the school it is easy to know the most pressing items needed as well as the required quantity.

This is applicable to other areas. For instance, allocation of students to various hostels can be achieved conveniently using the information stored in the database on hostel capacity, number of beds and cupboards. On the other hand the problem of congestion can easily be identified and tackled having information on enrollment, the number of students in each hostel, available facilities and capacity as well the number to be allocated to each hostel.

4.6 **Data updating provision**

In the past maps were static and could only be made by skilled cartographers. With GIS everyone can make map and change them over and over as soon as there is a change unlike map update that usually takes a long time to be achieved manually. This is a great advantage since the areas being mapped are not static. They are continually undergoing changes as a result of population increase and development projects. This is applicable to both spatial and attributes data. The figure below (Fig. 4.6) shows the updated map of the school showing the new dinning hall building which was not there at the on set of this research work.



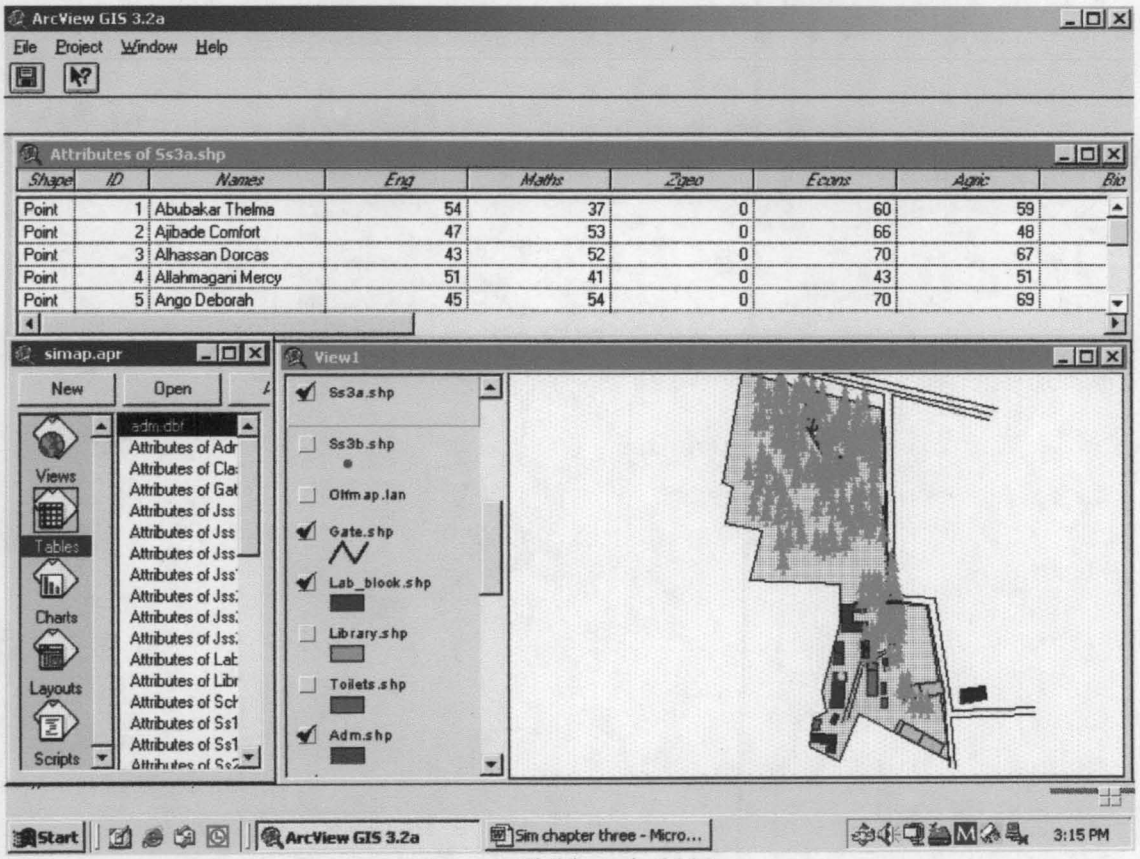
Source: Field work, 2005

Fig 4.6: Updated map of the school

4.7 **Academic Record**

In the school system one of the most important documents is the student's academic record. This is because the desire of every parent is to see the child progressing academically and no school would love to be known with poor performance. The screen print below shows students result in a terminal examination. With these information students results can easily be referred to by the school administration, parents as well as students themselves.

There is also room for future results to be entered which will help in assessing the child's performance over time. This will help in determining whether the child is improving or not and the subjects that need to be improved upon since the child's performance can be clearly seen as well as the average performance over time per subject. Such information can be useful in selecting students to represent the school in activities such as quiz, debate, awards and leadership roles.

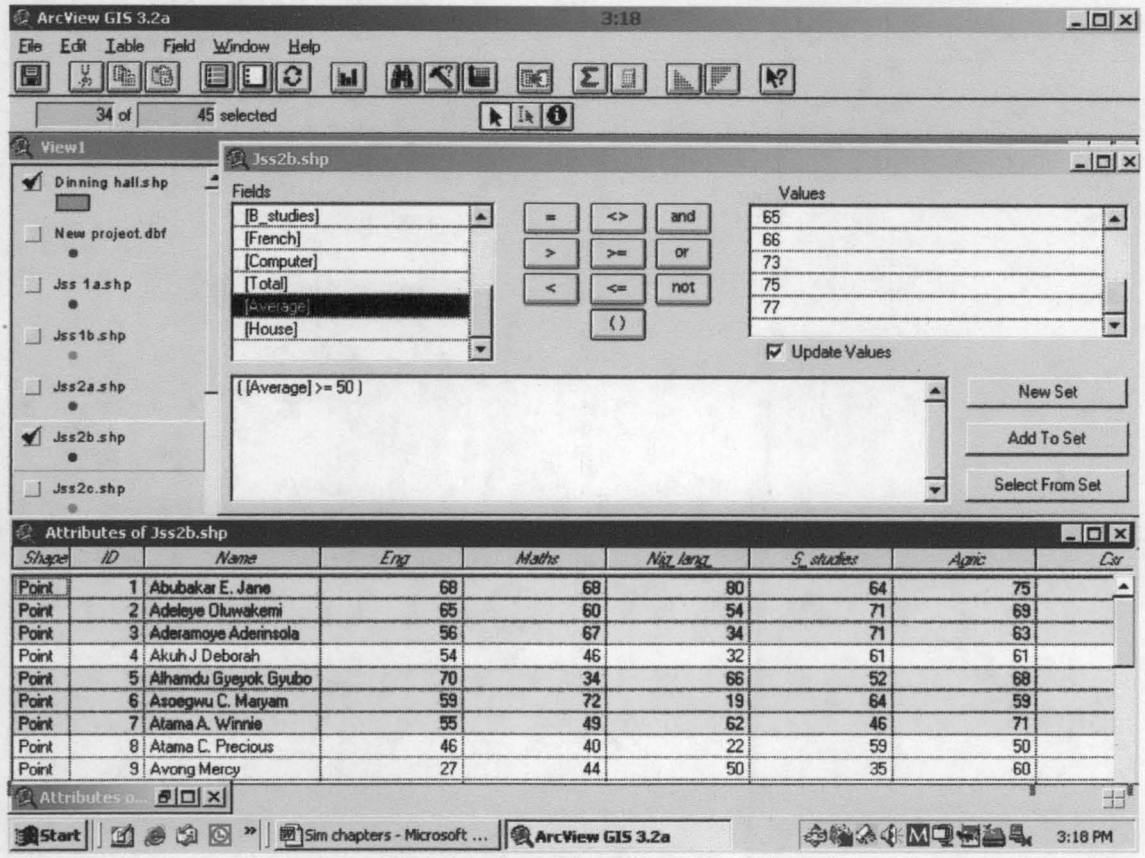


Source: Field work, 2005

Fig.4.7: Students performance in terminal examination

4.8 **Database Query**

Figure 4.8 shows the output of the query performed on SS 1B students to determine the number of students that passed the promotion exam with a benchmark average of 50% and above.



Source: Field work, 2005

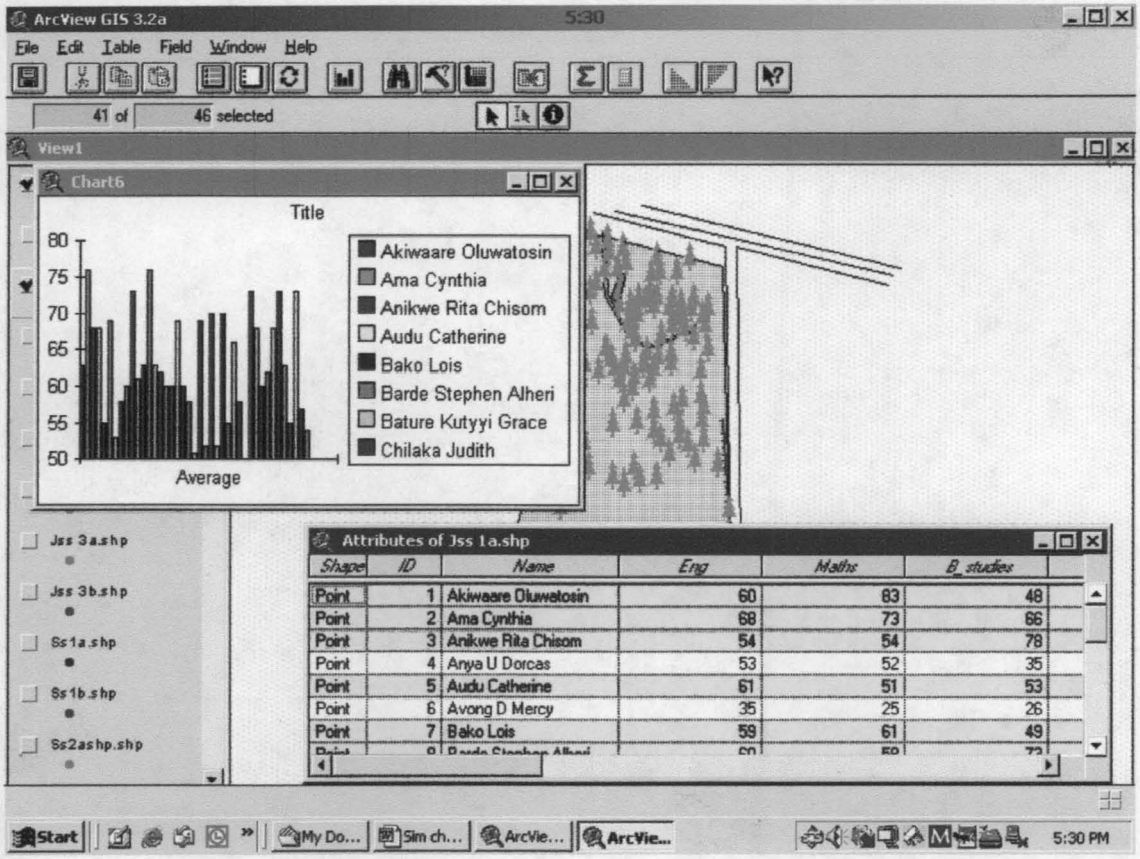
Fig.4.8: Database Query for Students performance in terminal examinations

One of the advantages of a geospatial database is the ability to search through a large data (query). Query was performed to get information about students' performance i.e. selecting those that performed above average from those that performed below average. Those that performed above average are represented with yellow while those ones below average are represented with white. This will aid in taking decisions for

improvement particularly working on those below average. When majority fall below average different possibilities can be looked into to find out where the problem lies. For example the performance of teachers and availability of teaching aids e.t.c. Performance of students in different classes can also be assessed and compared for decision to be taken particularly when a particular class is performing far better than its other counterpart. The database contains valid information to help decision makers in taking a step towards improving the performance of the students.

4.9 **Database and Statistical Analysis**

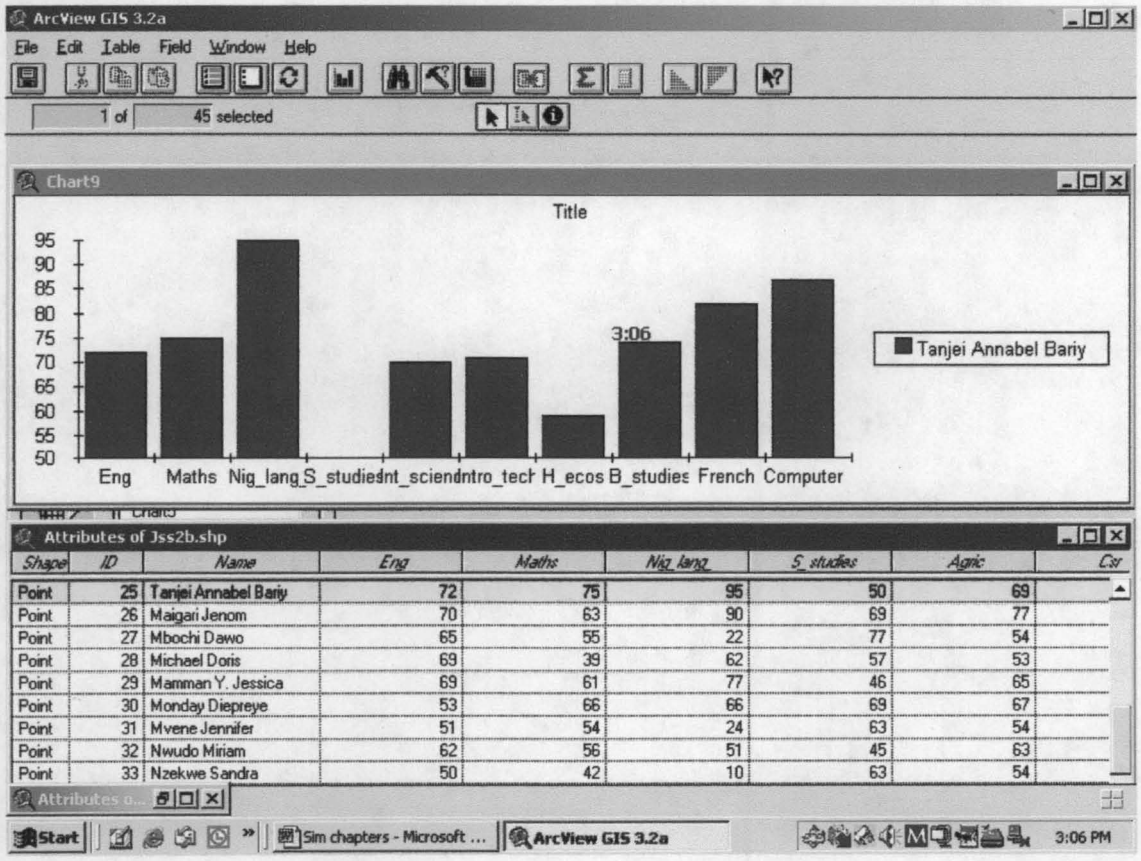
The results and subject analysis can be presented in statistical format showing a summary in pictorial form i.e. charts (Fig.4.9). Charts are graphic representation of tabular information while tables contain descriptive information about geographic locations in this case students of a particular class (JSS1A) in Our Lady of Fatima Girls Secondary School Kaduna. Charts can help you interpret and analyze your data. You can choose the chart type appropriate for your data e.g. pie or bar charts. In this analysis the performance of JSS1A students by average is represented using bar chart. A child's performance can be seen easily compared with the other students in the class. If there is so much gap between the students then the school authority must take a step to improve the weak ones. Many factors can be responsible for poor academic performance, some of which can be handled if proper care and attention is being given. For instance, those from a poor background can be taught some basics in other to catch up with others while those with psychological problems can be counseled.



Source: Field work, 2005

Fig.4.9: Statistical analysis of Students performance in terminal examinations

A child's performance in various subjects can also be viewed using charts, (Fig.4.10). Query was performed using 50% as the benchmark. It can be clearly seen that the student by name Tanjei Annabel Bariyat performed below 50% in social studies being her weakest subject while Nigerian Language happened to be the best. Therefore the student can easily see where she needs to improve, the parent can easily identify the child's area of need e.g. when employing a lesson teacher during holiday.



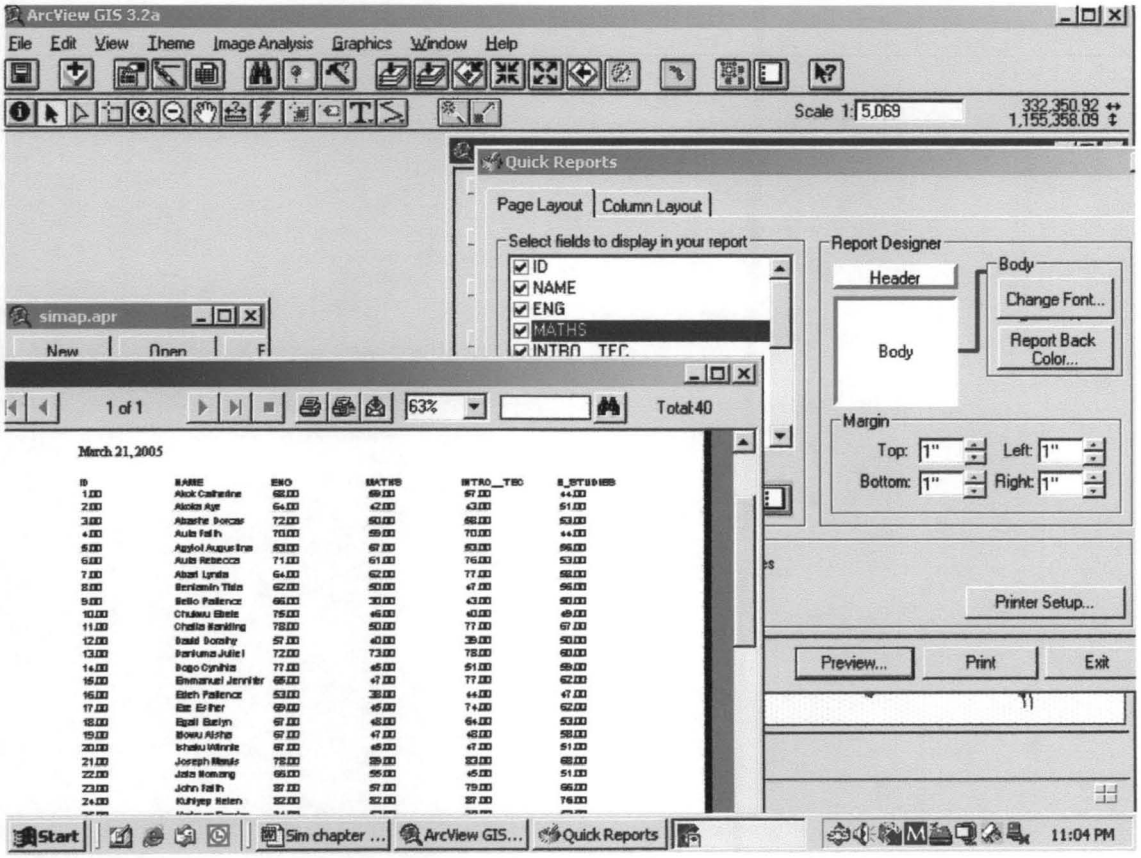
Source: Field work, 2005

Fig.4.10: Statistical analysis of a Students performance in various subjects.

Result analysis in general is very important for career guidance. The guidance and counseling teacher will find it very useful in directing the students about their choice of career. The examination office will find it useful too particularly in compiling continuous assessment for examination bodies such as the West African Examination Council (WAEC) and National Examination Council (NECO) as well as analysis of results for the Inspectorate Division and Ministry of Education.

Preparing a report to the Ministry of Education on Students performance in Mathematics for a National mathematics competition entry.

A summary of student's performance in mathematics is being illustrated. This will aid in sending a report on students representing the state in a competition with ease within a short time and without subjectivity since it will be based on their performance already stored in the database. Otherwise the selection can be biased if the mathematics teachers are to make the selections and the time it will take them to decide on whom to pick is also a thing of great concern. GIS therefore, reduces segregation to a large extent.

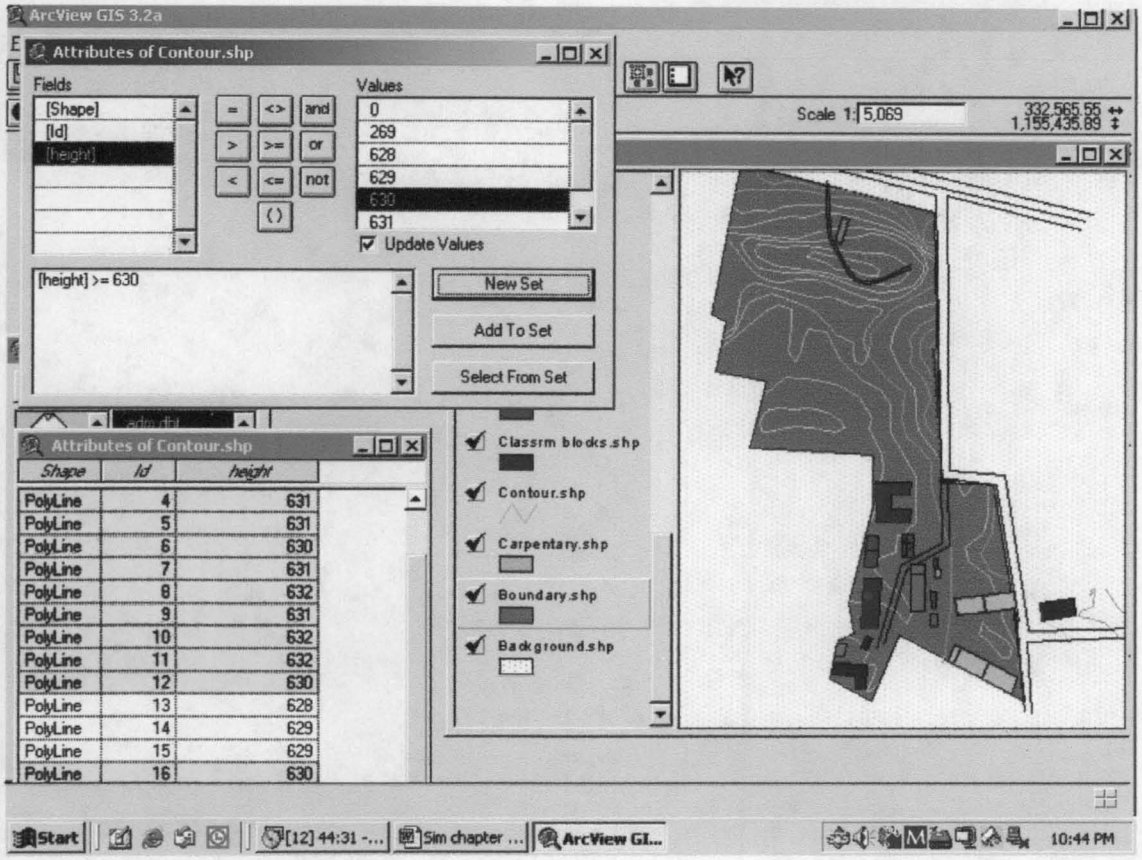


Source: Field work, 2005

Fig.4.11: Summary report on Students performance in Mathematics examinations.

4.11 Conducting a needs Assessment for project site

Information from maps can be combined and manipulated in GIS to address planning and natural resource issues. In the project context, GIS information can be used to locate a potential site for a new sport complex project within the school compound.



Source: Field work, 2005

Fig.4.12: School topographic assessment for project suitability

GIS offer such necessary information on the topographic nature of the school, distance to and from e.g. classrooms/hostels in order to avoid noise/distractions, size of available area e.t.c. which are requirements for the choice of such project site. Figure

4.12 shows that the topography of the school is relatively flat giving one colour (green) all through.

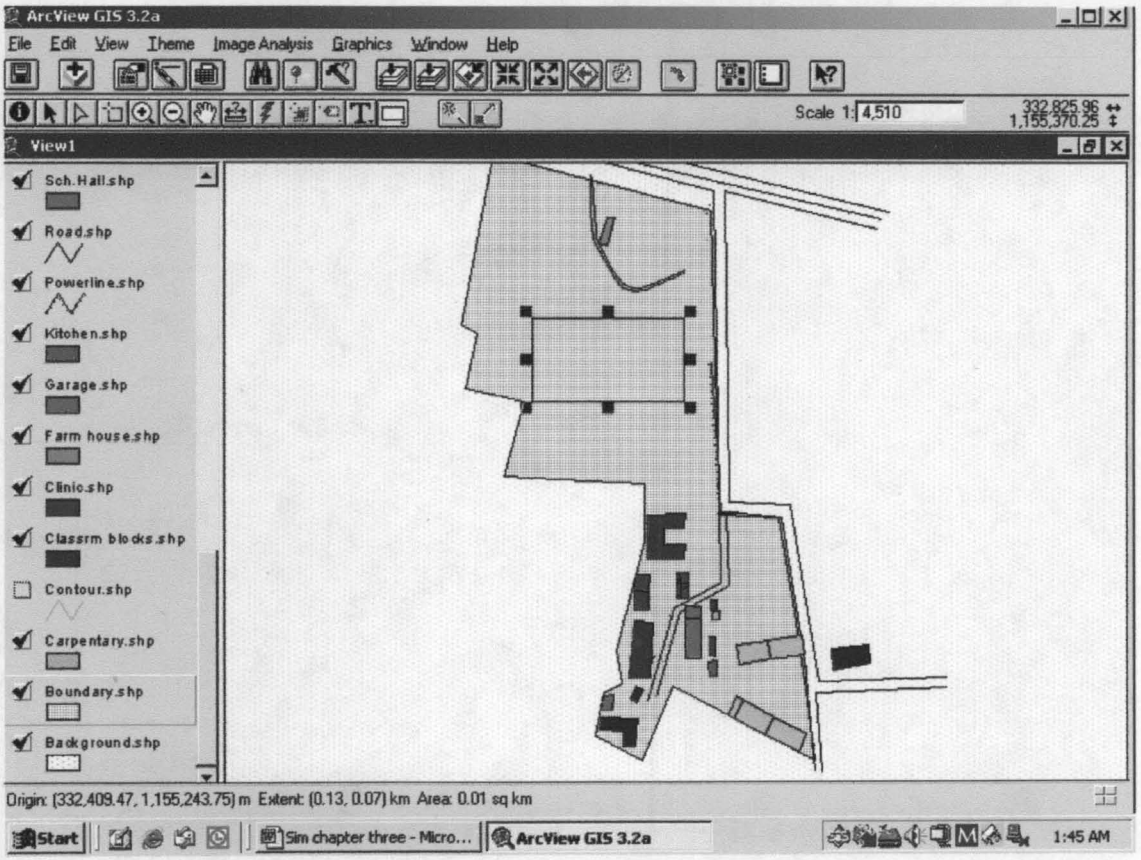
It should be noted that some other study areas would rather be characterized by highlands and lowlands then the best site would have to be chosen depending on the type of topography needed for the project in question as the view will be fully displayed. Other environmental aspects can also be taken care of such as areas prone to erosion and flood among others. This will help in avoiding loss of lives and properties to such disasters.

With the measure tool, distance can be measured on a view for the said sport complex without having to go to the field for measurement (Fig. 4.13). A mouse is used to draw a line defining the distance you want to measure. The measurements are displayed in the ArcView status bar, shown in the current distance units of the view. For example, the game master may be asked to measure the undeveloped portion of the school to see if the space would be adequate enough for the proposed standard sport complex project. With the GIS database all he needs to do is on-screen measurement instead of direct manual measurement with tape.

Shapes can be used to make measurements of features with both regular and irregular shapes. With the aid of a draw tool to draw shapes on a view, the dimensions of the shapes are displayed in the status bar in the current distance units of the view. The figure also shows the chosen site as well as the measurement of the required size and shape for the sport complex.

This is a useful way to make measurements because the distance or area you measure remains displayed on the view as a graphic shape, which you can then edit using

the Pointer tool. If you change the shape or size of the graphic, its new dimensions are shown in the status bar. You can also change the parameters of a graphic shape using Size and Position in the Graphics menu. The figure below is an illustration of the selected area for the sport complex.



Source: Field work, 2005

Fig.4.13: Field Measurement

GIS integrates all natural, social and economic Phenomena with their attributes of space and time (Jones, 1997). Indeed GIS capability is enormous and has developed over the past three decades that it is now accepted as an essential tool for the effective use of

geographic information. It has provided an exciting potential for geographic information to be used more systematically and by greater diversity of discipline than ever before (Aronoff, 1993). Carey (2002) in recent years there have been north worthy changes in the types and successes of GIS implementations. Therefore, GIS should be used instead of the analogue method of decision making in schools for efficiency and effectiveness.

CHAPTER FIVE

SUMMARY OF FINDING, RECOMMENDATION AND CONCLUSION

5.1 Summary of finding

This study demonstrates the importance of GIS database as a tool in decision making for school planning and management. The knowledge of GIS in school facilities planning and development cannot be over emphasized. Thus the end product of the GIS as part of an Educational Decision Support System would provide the user with a map of specific feature with focus on the schools locations and all related information to assist decision-making in either expanding current school or suggesting sites for new projects and for students and resources location and allocation.

The following are some of the findings that resulted from the geo-spatial database developed:

It combines many layers of information unlike paper map where "what you see is what you get". Users can identify feature attributes on a map by a click of the mouse. The power is that one can see a broad picture of information in seconds and it is in form that is easily understood.

It makes it possible to integrate all data into one system. The ability to integrate all data into one system and analyse spatial relationships has proven to make the whole process much more accurate and efficient. With all these capabilities decisions that once seem so difficult and required weeks and months of planning can be made in seconds. For instance, when determining the best sites for construction of buildings, roads e.t.c. there was need for several meetings for many considerations to be made and ground surveys.

All these have been overcome with GIS since points/issues to be considered are already incorporated into the system.

The findings can be summarized thus:

1. It allows for data availability and update for both spatial and attributes data.
2. Aids quick retrieval of information.
3. It allows for accuracy and precision measurement and saves time.
4. It allows for data queries by selection/through query builder for instant result.
5. It's interactive and easy to understand by the user.

5.2 **Conclusion**

The school system has immense potentials for developmental activities such as providing basic amenities in terms of their health, drinking water, electricity, recreational and most importantly academic activities/amenities for increasing number of students being enrolled

The use of GIS technology in modeling for decision making bring about different capabilities and commodities that is new to the planning process. The study summarizes the various ways of building a geospatial database that would serve both public and private schools decision making. The decision support system illustrates the success of implementation of the planning process in taking many decisions for projects based on such technology. To merge geospatial database using all vector layers is quite complex environment and is the scope of many research projects. However, the testing had shown that it can be done within the accuracy requirements of a map.

The information compiled to implement this GIS application ranged from datasets of the entire school and their attributes which allowed for relationships to be established. The integration of these data goes a long way in meeting the needs of decision makers.

5.3 **Recommendation**

As earlier stated there is so much to accomplish with GIS for school decision making. I therefore recommend further studies to explore this technology in areas such as integration of Geo Imagery and Vector Data into school mapping as Educational Decision Support System not only for individual schools but for an entire directorate to aid decision makers in either expanding current schools or suggesting new sites for new schools, generating data relating to schools physical environment in the metropolitan city or the state at large. Databases of individual schools in the directorate put together will make up a comprehensive database for the whole directorate because of the following advantages:

(1) It will show the overall distribution of current schools in the area on a map and all related information.

(2) Maintaining school capacity in terms of the ratio of available classroom area per student following the required standard of $1.2m^2$/student can be achieved.

(3) Illuminating and/or minimizing double shift schools (i.e. morning and afternoon schools in the same building) will become possible.

(4) Increase in population of the area for the next ten years can be matched (based on a computed ratio) e.t.c.

Other areas like School Security Application can also be worked upon as Crisis Situation Information Management in our schools.

Building geospatial database with relational databases of education, demographic, social and economic information for schools and educational directorates to support educational planners and decision makers is a technology in the right direction to better decision making in the management of education services which should be taken up by schools and the Ministry of Education with all seriousness and in no distant time.

In order to do proper planning, the educational sector should not start any project before making available to all involved parties a comprehensive database of all schools, pupils, teachers and resources. Building that part of GIS layers showing school locations and other significant geographic features such as roads, classroom blocks, school farm, laboratory, staff quarters, water supply and other features would provide an excellent tool for planners.

In order to succeed in the implementation there is a great need for creating awareness and then intensive training has to be conducted at all levels from administration to users, that is building the management capacity and staff in general to be capable of utilizing the technology. On the other hand experts are of major importance to train and guide, and can be a link between the geospatial database and the stakeholders who are managing and or using the data. Their major role is to ensure an efficient use of available data, models, developed software and theoretical knowledge. GIS is not static, therefore experts should also try to be current. Doing this will make Education Decision Support Systems usable and applicable and at the same time it will make the Decision

makers creative to ensure alternative solutions as they are the ones who really know the reality and what is considered applicable solution. Furthermore, the data has to be updated regularly in order to have up to date information on the school, in other words the present school situation.

Given the teeming population of Nigerian youths the need for GIS application in schools is of great importance and cannot be over emphasized. Therefore, its implementation should be taken up with immediate effect and all seriousness.

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