

# **Geographic Information System as a Decision Support System for Tourism Management in a Developing Economy: A Case Of Abuja, Nigeria**

**Kayode ODEDARE and Adedayo ALAGBE, Nigeria**

**Key words:** Tourist Sites, GIS, Database

## **SUMMARY**

The paper started with the design of spatial database as a decision support system for tourism management. The entities in the study area were identified and vector data model was employed, satellite imagery of the project site was georeferenced and digitized in ARCGIS 10.1 while the imagery data was updated with hand-held GPS. Attribute data for the site was collected through social survey. Spatial database was created in ARCGIS 10.1 where attribute table was linked with geometric data. Various spatial operations such as spatial query, best or shortest route and closest facilities were performed and results presented accordingly.

## **ABSTRACT**

In Nigeria, Tourism is growing rapidly and it is among the viable revenue earners for the country. Nigeria has a wide range of tourist activities to offer. However, many of these attractions are still largely untapped and even at their raw states; they are still being enjoyed by few outsiders, either very rich visitors in quest of exoticism or adventurous people in search of new challenges and experiences. Worst still, some of the tourist sites are not known and those that are known are not published on the net to make them accessible. This paper discusses how Geographic Information System technology could serve as a decision support tool for tourism management in ABUJA. GIS functionality was used to create digital spatial database for tourist site, hotels, hospital, police station and road network for tourist movement within ABUJA. The research involved the design of spatial database for various entities identified in the study area. Geometric data was acquired from satellite imagery through digitizing and the imagery updated through hand-held GPS receiver while attribute data were acquired through social survey. ARCGIS 10.1 was used for database creation where attribute tables were linked with geometric data. Various spatial operations were performed and these include spatial search and closest facility analysis to efficiently guide tourist movement in ABUJA. The study was concluded by recommending various ways to promptly identify tourism sites, managing tourist movement and solving direction finding problems for tourist

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## **1. INTRODUCTION**

Tourism is an economic activity of immense significance and one of the world's fastest growing businesses today (Pender L., 2005). It has been noted as an agent of change, bringing myriads of impact on regional economic conditions, social institution and environmental quality (Mings RC and Chulikpongse S 1994). Almost all sector of the economy benefit from tourism (Cardoso C and Ferreira L, 2000). And according to Eccles ca. (1995), tourism is used to augment the local economy. He says that in Africa, tourism revenue has been used to improve the infrastructure as well the economy. It is therefore important to understand the economic benefits of tourism and the costs that may be attached to these. Surveys on the Nigeria tourist potentials conducted by the African development bank in 1971 revealed the country's existing and latest tourism potentials. The resources include physical attraction sites, cultural heritage, museum and monuments. The physical attraction sites are either man made or natural. Some of the natural attraction sites include the various National Park and Game Reserves, warm spring, waterfalls, beaches and hills, while the man-made attraction sites includes the hotels, city parks, palaces and ancient settlement areas. Cultural tourism has also a significant position in tourism destination areas within Africa. Nigerian cultural heritage is complex and each community is endowed with rich cultural heritage and different tradition. In other to sustainably develop and manage tourism, profound understanding or knowledge of spatial distribution of tourist sites, tourism facilities, tourist flow, becomes imperative and also the spatial patterns of tourist movements between destinations, within destination, tourist motivation, tourist needs and facilities required. Geographic information system is an information system which has the capability to handle spatially distributed data, relate them to other numerical or descriptive data, and present the data visually on a map, reports, chart etc..There is no doubt that GIS possesses significant potential as decision support system for Abuja tourism management. Tourism site specification information about sources of visitors origin and destination, travel motivation, spatial patterns of recreation and tourism use, visitor expenditure patterns, level of use and impacts and sustainability of tourism site for recreation/ tourism development, numbers of hotels, hotel rooms available in the city and the type of services, all of which are easily implemented in the GIS arena. The fact remain that GIS technology is an essential and effective decision support system for tourism management.

## **2. STATEMENT OF PROBLEM**

The tourism industry is a large and complex industry and one that is of significant economic importance to Nigeria. The success of tourism business is determined by the planning, development and management of the industry. Although Geographic information system is well suited to the practice of tourism planning, development and management, the use of Geographic information system technology in tourism is still limited in Nigeria, as the general

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lack of tourism database has led to poor tourist management, poor patronage of tourism destination, lack of awareness of existing tourism facilities by potential tourist, limited information about destinations, tourism manpower needs and planning. This research was therefore motivated by the need to fill the above gaps in knowledge by generating database on tourism in Abuja that could underpin future tourism management strategies and policies in the Federal Capital Territory (FCT).

### **3. AIM OF THE STUDY**

The aim of this paper is to develop a functioning tourism database and examine how Geographic Information System technology could serve as a decision support system for tourism management.

### **4. OBJECTIVES OF THE STUDY**

The objectives of the study include:

- I. Design a tourism database for Abuja
- II. Identify the geometric and attribute data of the tourism destination.
- III. Create a tourism database for Abuja tourism
- IV. Create attribute tables for the tourism destination and link these tables to their geographic location.
- V. Carry out spatial analysis of possible routes from Hotel to tourism site and from tourist site to facilities of need to the tourist.
- VI. Information presentation based on evidence from data analysis.

### **5. STUDY AREA**

Abuja officially became Nigeria's capital in December 1991, following relocation from the former capital Lagos. It is one of Africa's few purpose built cities. It has been reported that the population in some areas in Abuja is growing by as much as 20-30% per annum Abuja, Nigeria's capital City is located at the geographical centre of the country approximately at latitude  $9^{\circ} 12'$  north of the equator and along longitude  $7^{\circ} 11'$  East of the Greenwich Meridian Abuja has an estimated population of 1.4 million people [5]. It has a total land area of approximately 713 km<sup>2</sup>.

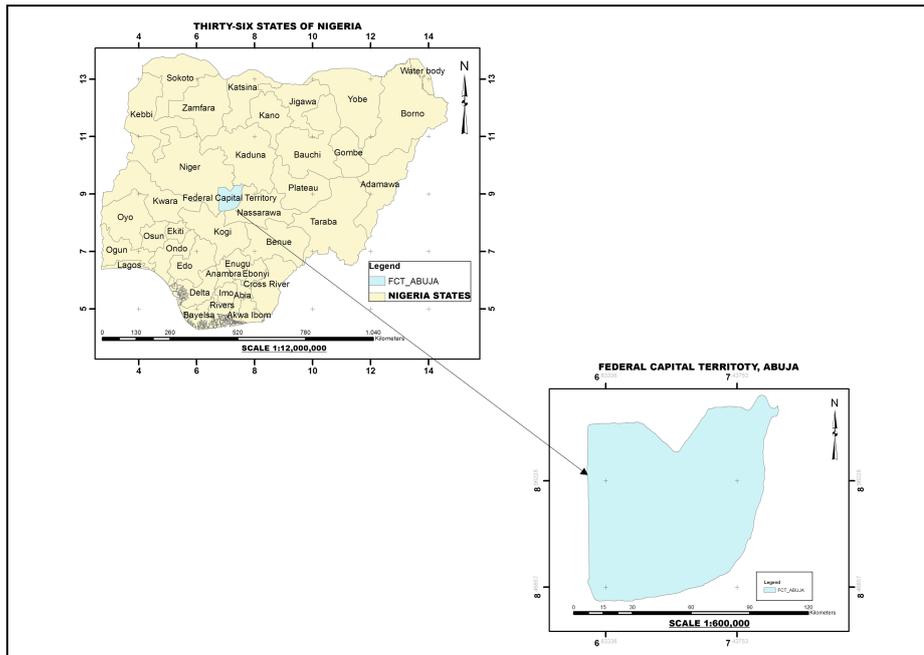


Figure 1: Location of the study area

## 6. METHODOLOGY

This section deals with database design, collection of geometric and attribute data and database creation.

### 6.1 Database Design

Spatial database is the central force of GIS technology. It is a tool that is useful in GIS for several applications and also it has the potential to further enrich the GIS, Kufoniyi (1998) described GIS data modeling as process by which the real world entities and their interrelationship are analyzed and modeled in such a way that maximum benefits are derived while utilizing minimum number of data. The design phase consists of three phases namely: Conceptual, Logical and Physical

**Conceptual Design:** Conceptual design is the arrangement of a human conceptualization of reality, how the view of reality will be presented in a simplified manner but still accommodate the information requirement for successful implementation of the project at hand. Abstraction of reality was done which aided the designing and creation of the database. For this study, the reality stands as the spatial arrangement of tourism site in other to see their spatial relationship with other factors that interact with tourism, such as road, hotels, hospital, recreation, police post, etc. This research project considered the following entities: Tourism sites, Hotels, Recreation Park, Hospitals, Police station Arts and Culture Center and Road. The vector data model was adopted for the representation of the complex reality in this study.

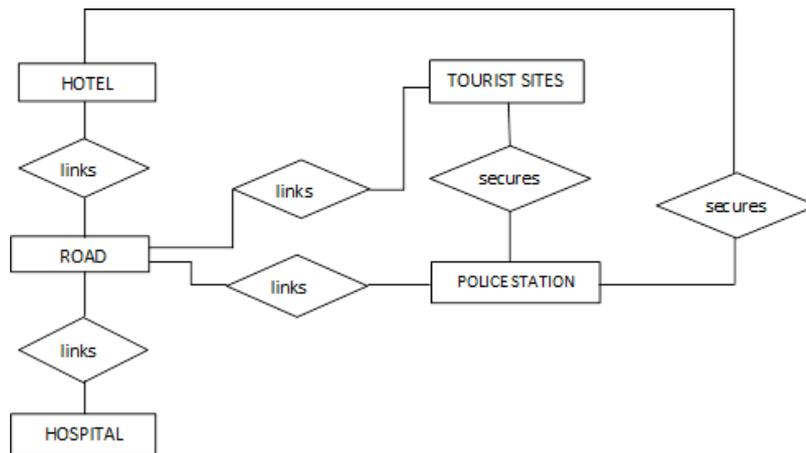


Figure 2: Entity Relationship diagram of the study area

**Logical Design:** The conceptual model in figure 1 was translated into a logical data structure and the following schema was derived.

1. TOURIST SITE (Trmsite\_id, Trmsite\_name, Trmsite\_add, Trmsite\_fac, Trmsite\_owner)
2. ROAD (**rd\_id**, rd\_name, rd\_type, rd\_length)
3. POLICE STATION (**PS\_id**, PS\_name, PS-add)
4. HOSPITALS (**H\_id**, H\_name, H\_add)
5. HOTEL (**Ht\_id**, Ht\_name)

## 6.2 Dataset Required

The secondary data used include the IKONOS image of the study area which was collected from the office of the Surveyor General of the Federation, Abuja, Nigeria while primary Source involved direct acquisition of location data of Tourism site, Hotels, Recreation places, Hospitals, Police station, and Cultural centre Position through field observation using the Garmin handheld Global Position System (GPS) receiver.

### *Physical Design*

This is the representation of the data structure in the format of the implementation software. The implementation software is ArcGIS 10.1. The data types used were Text, Number and Double.

## 6.3 Database Creation

IKONOS imagery of Abuja was geo-referenced and digitized using ArcGIS 10.1. Following the design phase, the database was created and populated in ArcGIS 10.1. Polygon, Line and Point layers were created respectively for Tourism site, Hospitals, Recreation centre, Hotels, police station and Roads data. These form individual relations which were then populated

with their attribute values.

Table 1: Sample of Tourist Site table created in ArcGIS 10.1

<b>OBJECTID</b>	<b>x</b>	<b>y</b>	<b>Trmsite_Name</b>	<b>Trmsite_Address</b>
<b>1</b>	336660.6	1002684	National Arboretum	43 Circular way
<b>2</b>	335198.1	1002852	Millennium Park	14 Circular way
<b>3</b>	334150.5	999964.4	International Conference Center	92 Herbert Macaulay Way
<b>4</b>	336407.1	1004570	IBB Golf Course	84 Muritala Mohammed
<b>5</b>	330082	999826.2	Wonderland Amusement Park	19 National Stadium
<b>6</b>	329608.8	999506.6	National Stadium	26 National Stadium
<b>7</b>	335092.8	1002087	Eagles Square	120 Shehu Shagari
<b>8</b>	333372.6	999432.6	Abuja Art and Culture	25 Moshood Abiola
<b>9</b>	333338.6	1002425	Art and Craft Village	61 Memorial Drive

#### **6.4 SPATIAL OPERATIONS**

The spatial data acquired in this research were linked to the attribute data and used to demonstrate how GIS as an analytical tool can be used to answer basic generic questions in GIS

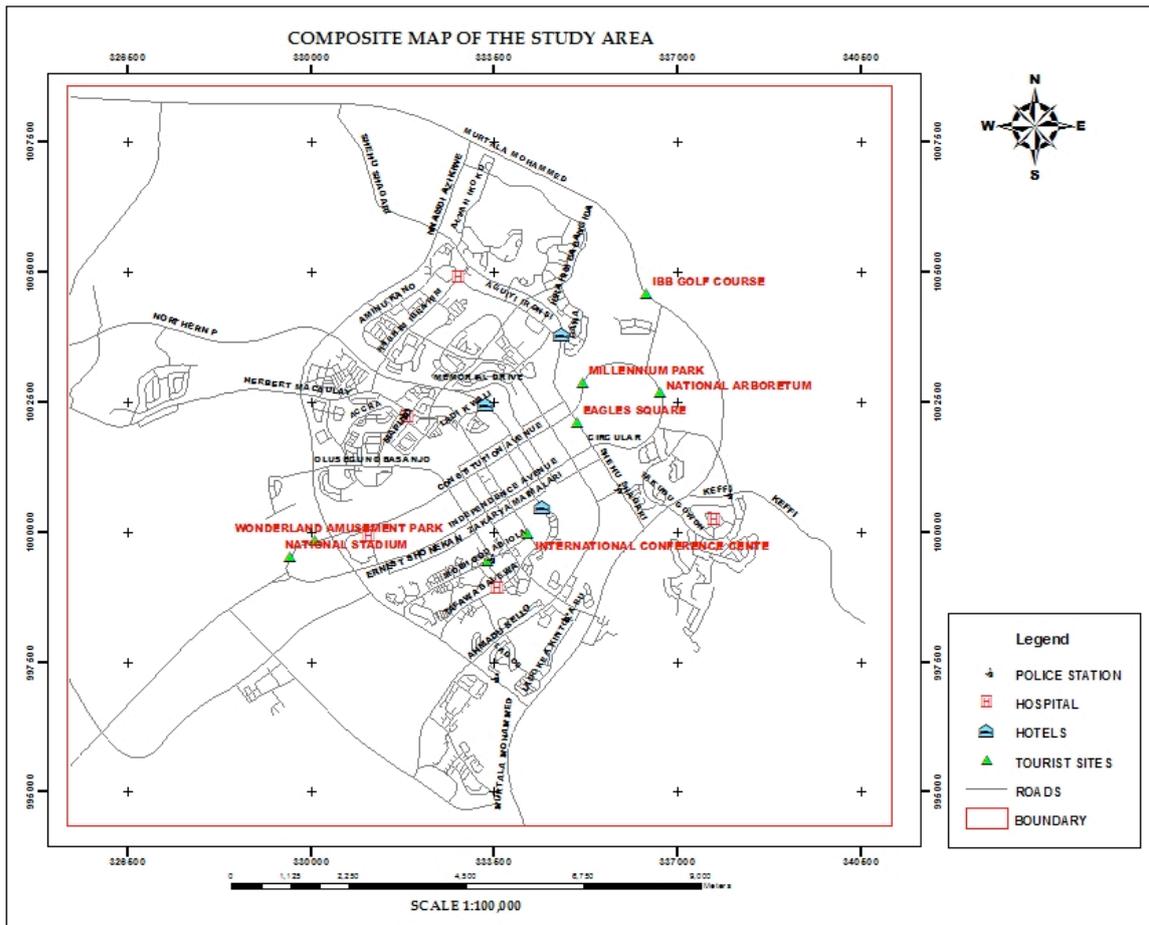


Figure 3: Composite Map of Abuja Municipal area

### 6.4.1 Spatial Search

Spatial search was used to test the database created by looking for certain attributes within Abuja, which was logically and systematically defined. Query Syntax: [TRMSITE\_NAME] = 'INTERNATIONAL CONFERENCE CENTE'

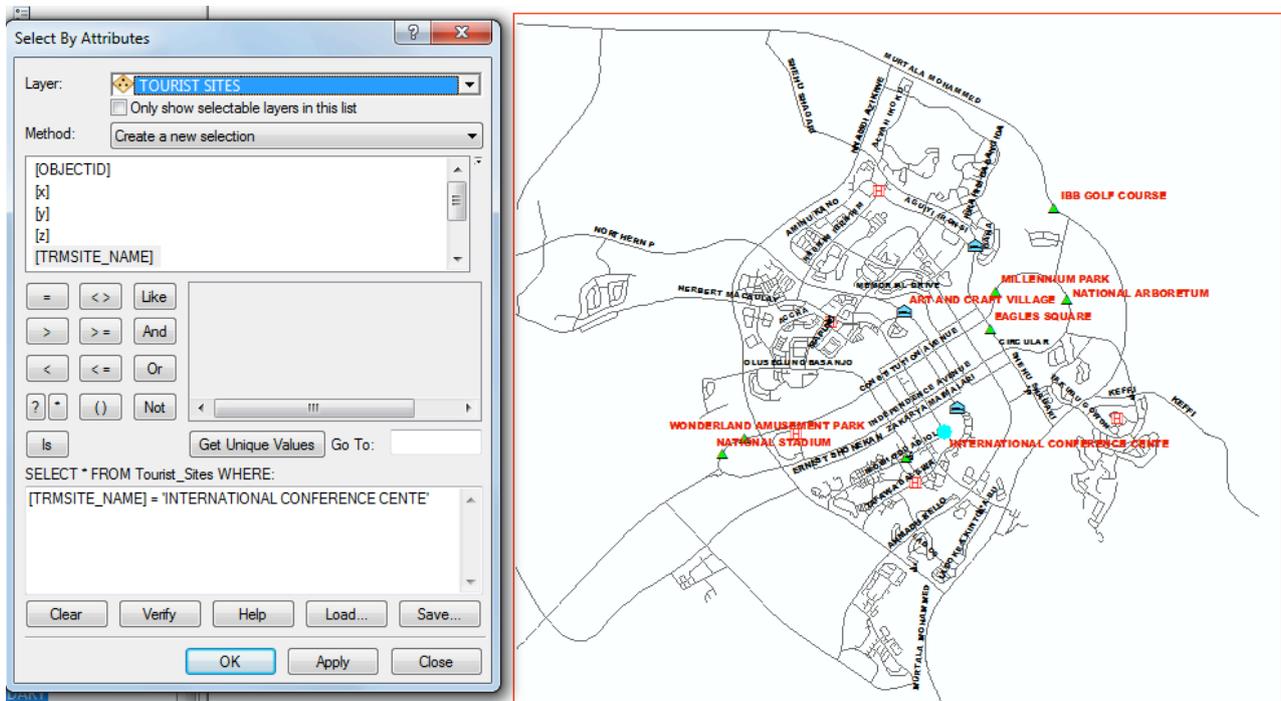


Figure 4: Query for International Conference center within the study area

### 6.4.2 Closest facility Analysis

Closest facility is a network analysis that is used to determine facilities from a current location or to any location on the network. Two Closest five star hotels were determined from a tourist site – Abuja Arts and Cultural center (See figure 4).

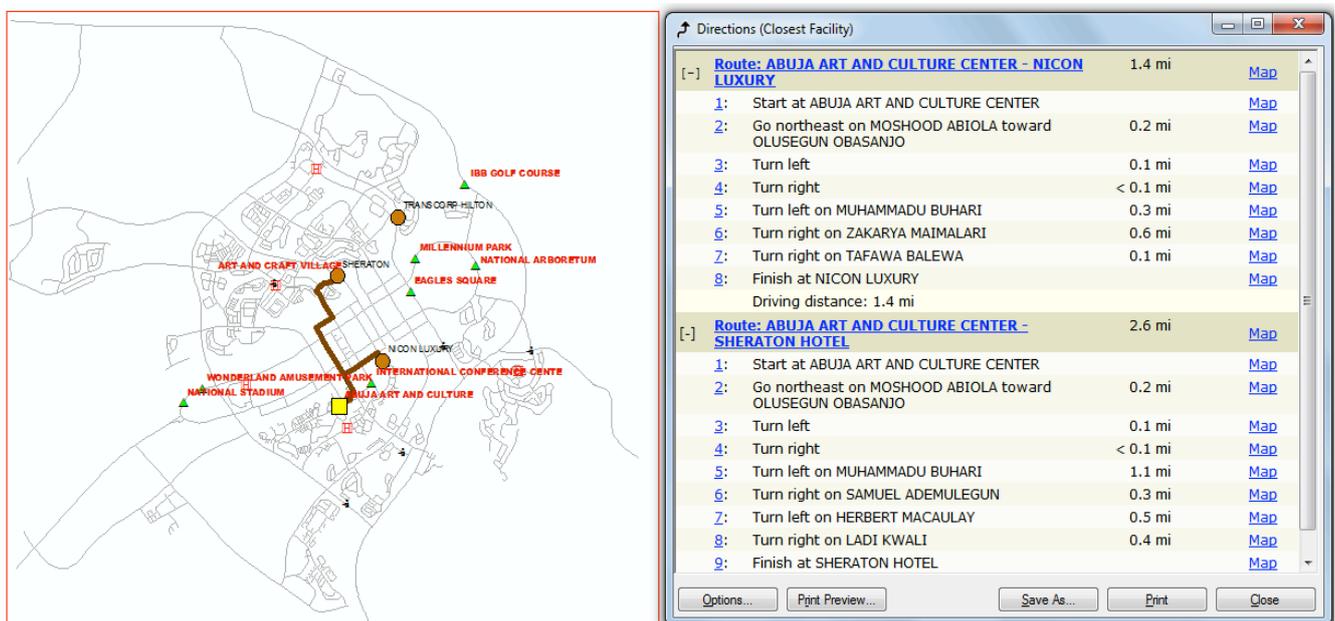


Figure 5: Result of closest facility analysis and the direction window

## 6.5 Analysis of Results

Figure 2 shows the extent of the study area and the various features that were identified and mapped. These include the tourist Sites, Five Star Hotels, Police Stations and the Hospitals. In figure 3, a spatial query was performed to show the International Conference Center. Similar queries can also be performed on the database to reveal tourist sites of interest. Figure 4 shows the two closest hotels to the Abuja Art and Culture Center based on Closest facility analysis performed. The hotels are Nicon Luxury and Sheraton Hotels which are 2.2km and 4.2km respectively away.

## 7.0 CONCLUSION

The efficiency of tourism management has been greatly enhanced in this research by GIS. This research has revealed the tourist potentials in Abuja, the Federal Capital Territory of the Federal Republic of Nigeria. The tourist sites include physical attraction sites, cultural heritage, museum and monuments. Spatial database and a digital road network for decision support in tourism management have been created. This spatial database created can be manipulated to answer basic generic questions which can help tourist, tourism managers, planners, policy makers, and the tourism industry in general to achieve sustainable tourism development and provide better facilities and services to cater for the needs of the tourist and the environment

## 7.1 RECOMMENDATIONS

- The government should properly document all the tourist sites in Abuja and develop a functional tourism database using GIS technology to better enhance tourist experience and stay in Abuja as a tourist destination.
- Detailed information about tourism activities should be easily available and accessible from the tourism database.
- The tourism database should be made to cover the road network of Abuja and updated from time to time in order to capture new developing areas with the facilities that are present.

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## **BIOGRAPHICAL NOTES**

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