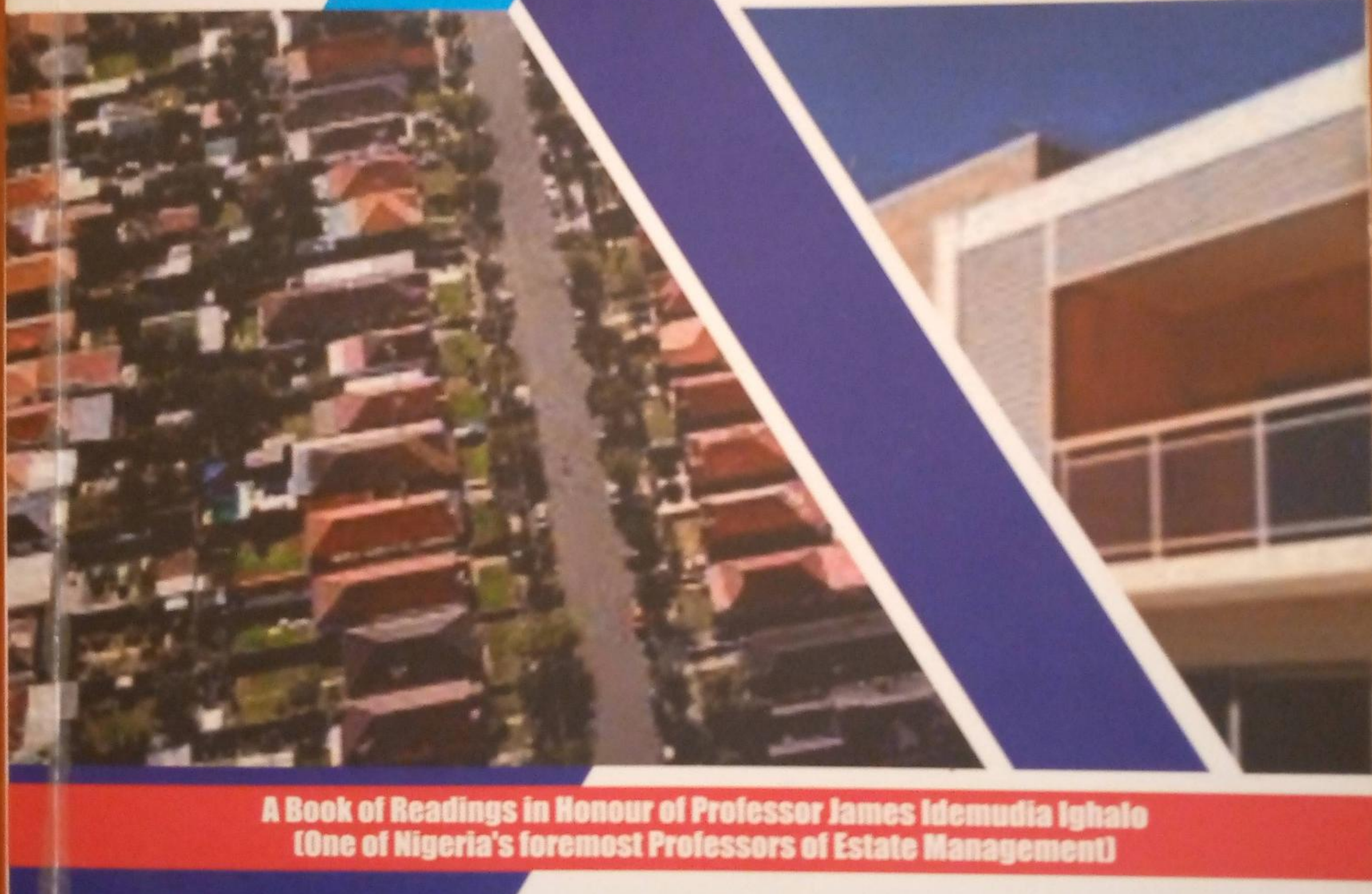
EMERGING ISSUES IN URBAN LAND USE AND DEVELOPMENT IN NIGERIA



A Book of Readings in Honour of Professor James Idemudia Ighalo
(One of Nigeria's foremost Professors of Estate Management)

Edited by:

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Foreword

Emerging Issues in Urban Land Use and Development in Nigeria is a book of readings on contemporary issues concerning the use and development of urban land in the country. The book is published in honour of Professor James Idemudia Ighalo, one of Nigeria's foremost Professors of Estate Management.

Prof Ighalo has contributed immensely to the growth and development of Estate Management Education in Nigeria for over four decades now. The Department of Estate Management and Valuation of this University is one of the beneficiaries of his teaching, research and mentorship. He, with other elders in the University provided great counsel that enabled me to settle down upon my appointment into a divided environment. Indeed, the University is grateful for this and in particular, I am glad that this book is published in his honour.

As its title suggests, this book of readings provides insight on emerging issues in urban land use and development in Nigeria. The topics covered in the book are based on specific sub-themes such as land administration and management, property valuation and appraisal, property taxation, housing, urban security, environmental sustainability, real estate education and practice.

It is my hope that all policy makers at the various tiers of government in the country and professionals involved in urban land use and development will find the book very useful. All libraries in tertiary institutions in the country offering courses in built environment should have copies of the book to aid teaching, learning and research.

I congratulate the Department of Estate Management and Valuation for this outstanding achievement

Prof. Musbau Adewumi Akanji, *FNSBMB, FAS*
Vice-Chancellor
Federal University of Technology, Minna, Nigeria.
August, 2017.

Chapter 29

Potentials of Geospatial Database for Urban Land Use Management: A Case Study of FUTMinna Staff Quarters, Gidan Kwano Campus

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Abstract

Geospatial database helps to provide information about real properties. This study attempted to develop a geospatial database that will assist in managing residential properties in FUT Minna Staff quarters at Gidan Kwano Campus of the University. Structured questionnaires were administered to collect primary data and the image of the study area was downloaded from Google earth. Maps were produced showing various conditions of the building elements, services and facilities in the study area using a likert scale-like criterion. The building elements, services and facilities considered were doors, windows, ceilings, roofs, access roads, electricity, water supply, security and landscape. Furthermore, the occupant responses were analyzed using equal weight by taking advantage of the commutative and associative properties of matrix addition in order to arrive at an overall suitability index used in ranking the houses. The use of GIS in property management practice has proven to be efficient and a highly relevant decision making tool.

Keywords: GIS, Database Management System, Facility Management, Coordinate Transformation.

Introduction

The application of GIS to property management makes its practice easier as it eliminates the challenges associated with management especially in terms of access to information, retrieval of

property information when du ...ers. It is obvious that GIS enhances real estate management capabilities (Asma, ...12). A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze and present geospatial data (Ukim, 2001; Oriola *et al*, 2007). It has capabilities for both spatial and attribute operation thereby allowing for all sorts of analysis (Peter *et al*, 2003).

Cadastral information basically consists of maps that depict the extent of property ownership. It comprises geometric descriptions of properties (size, shape and dimensions) as well as ownership and/or occupancy and value of the properties among others (Kemiki *et al*, 2015). In recent times, e-GIS is evolving with improved capabilities like an online database management that makes data retrieval faster, allows for multiple users at the same time and other cloud computation/manipulation of the database information (Opaluwa *et al*, 2014).

A mathematical approach is herein proposed for decision making in the management of the Federal University of Technology Minna staff quarters at Gidan Kwano Campus of the University. Earlier studies in the area of GIS application to property management have been limited to the use of linear regression models (Kemiki *et al*, 2015) and factor analysis for categorizing properties within a housing estate. In this study, the various building elements, services and facilities have been structured into a matrix such that simple matrix operations have been used to take decision about the overall condition of all the buildings within the study area. The method has proven reliable and yielded good results comparable to ealier studies conducted using regression analysis.

The Study Area

The study area is the the Federal University of Technology, Minna staff quarters at its Gidan-Kwanu Campus. The quarters consists of 25 housing units and is occupied by senior staff of the University. The site is as shown in Figure 29.1.

Figure 29.1: *google earth image of study area*

Methodology

Since a GIS comprises both spatial and attribute data, the spatial data was obtained via satellite image, obtained from google earth. The google earth image was then geo-referenced via co-ordinates of bounding points of the estate that are visible on the map and identifiable on ground. The geo-referencing was done in ArcGIS environment using a second order affine projection to translate the selected points from photo to ground co-ordinates.

Census sampling technique was used for acquisition of the attribute data within the study area. The property occupants were given questionnaires to fill which served as a basis for collection of the required attribute information about the buildings. The building attributes considered were external doors, internal doors, windows, floors, internal walls, external walls, roofs, ceilings, access roads, landscape, electricity, water supply and security. All thirteen attributes could be further classified into three (3) categories which are building elements (external doors, internal doors, windows, floors, internal walls, external walls, roofs and ceilings), services (electricity, water supply and security) and facilities (access roads and land-scape).

Each attribute considered was rated based on a 5-point likert scale of excellent, very good, good, fair and poor in as stated in AAPPA (2000). For easy mathematical manipulation, each attribute was rated using the likert scale and the rating of each attribute for all the 25 housing units within the estate was arranged in a 25*5 matrix. At the end of the study, rather than performing the numerical analysis using SPSS and its associated regression equation, matrix addition was done to harmonise all results as described in equations 1 – 2

$$A1 = Ceiling\ Condition = 25*5\ Matrix \tag{29.1a}$$

$$A13 = Security\ Condition = 25*5\ Matrix \tag{29.1m}$$

$$BS = \sum_{n=1}^{13} A_n \tag{29.2}$$

Where BS = Building Suitability

Owing to the associative and commutative properties of matrix addition, equation 29.2 resulted in a 25*5 matrix of which the factor sum of row elements gave an overall building suitability index for all the housing units. The matrix manipulation was done using MATLAB software.

After georeferencing the raster satellite image, the raster data were converted to a vector format via the conventional onscreen digitizing approach. All point, line and polygonal features were

digitized and saved in ArcGIS. With the resulting vector map related to the obtained attributes for each housing unit via a relational database, spatial query was used to get results from information stored and the resulting maps were generated.

Results and Discussion

Individual building elements, services and facilities were considered for all the buildings using a 5-point likert scale condition rating (excellent, good, fair, poor and very poor). Results obtained from the various respondents in all the 25 housing units for each element, service and facility is

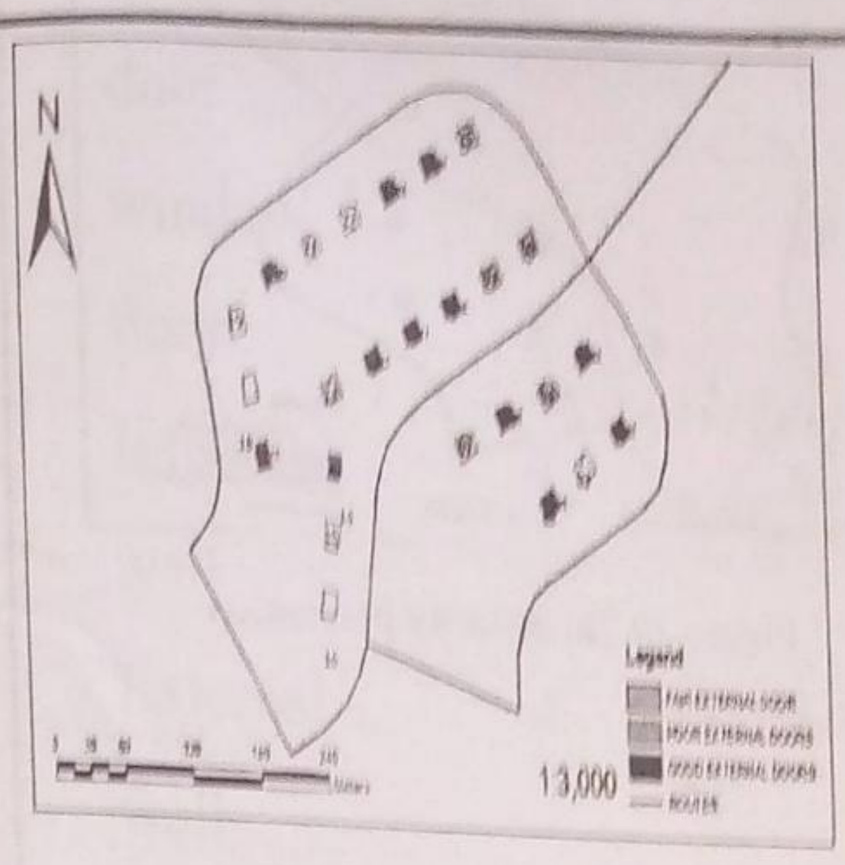

Figure 29.2a: External door condition

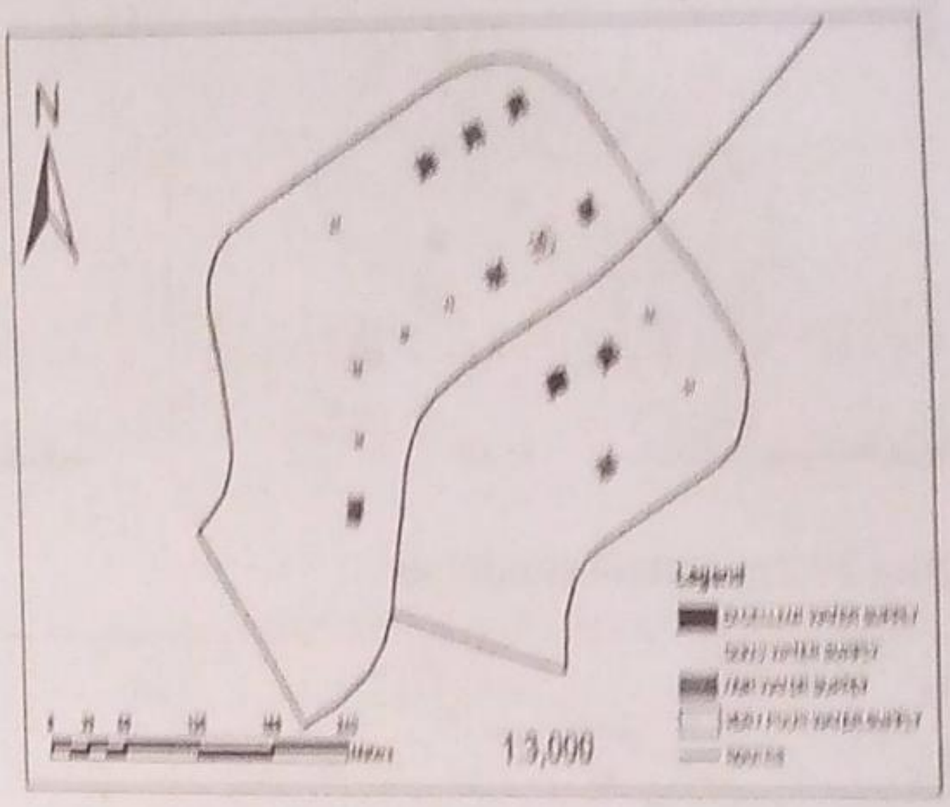

Figure 29.2b: Water supply availability

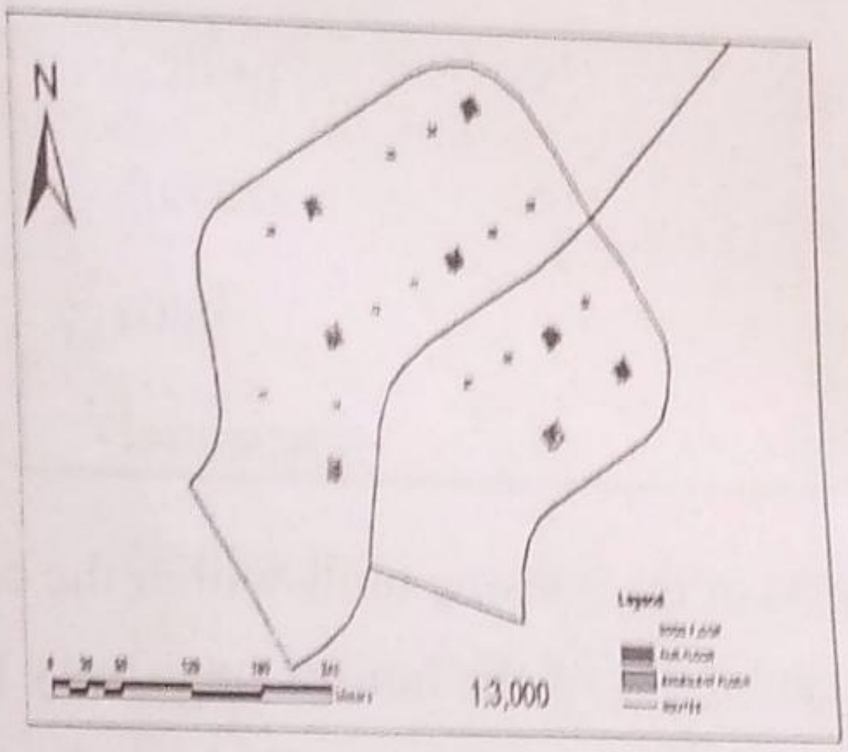

Figure 29.2c: Floor condition

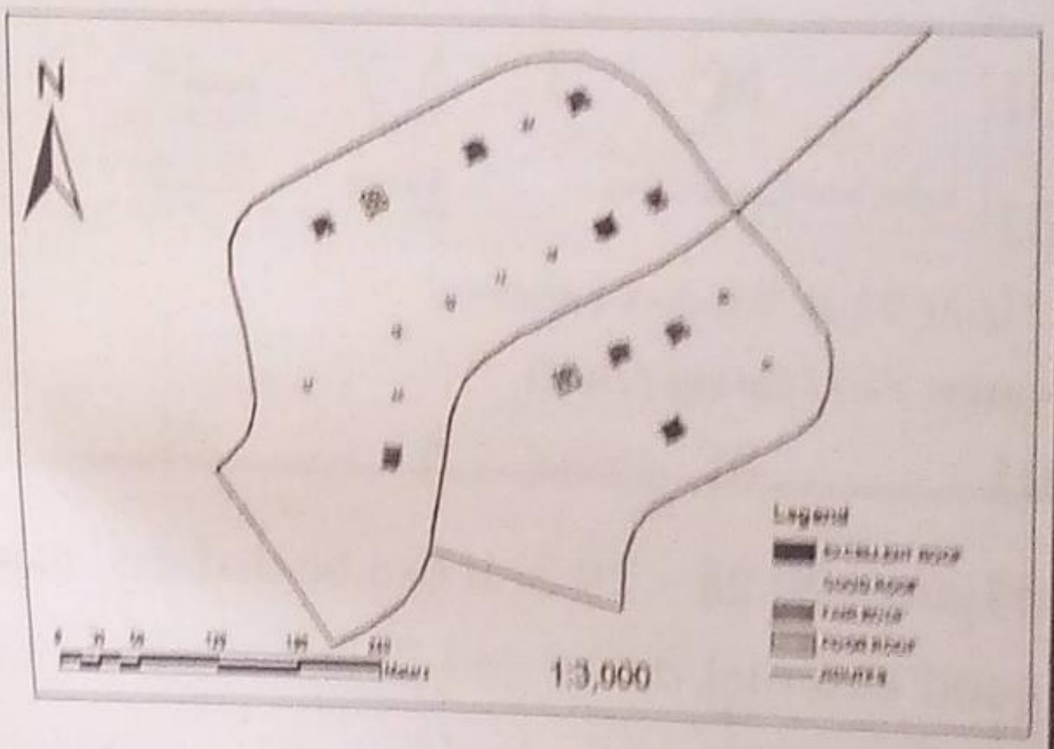

Figure 29.2d: Roof condition

Source: *Field Survey (2016)*

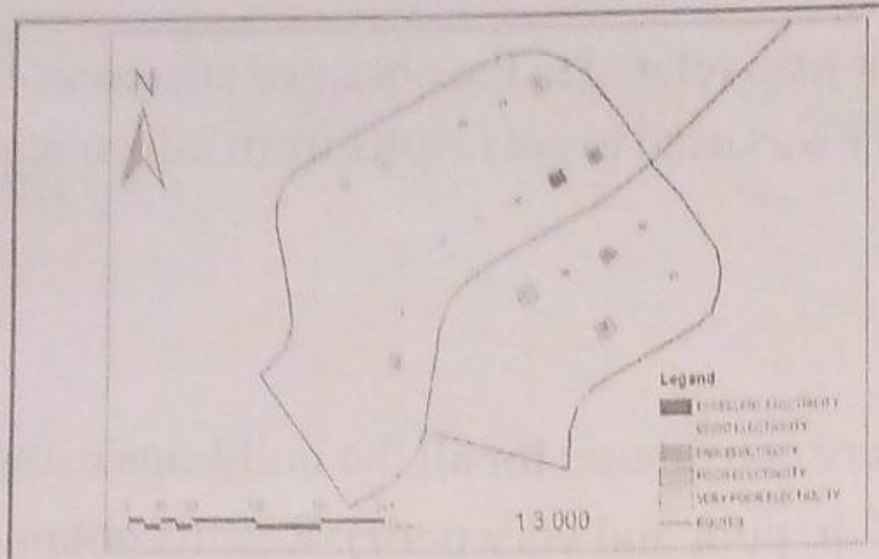

Figure 29.2e: Electricity condition

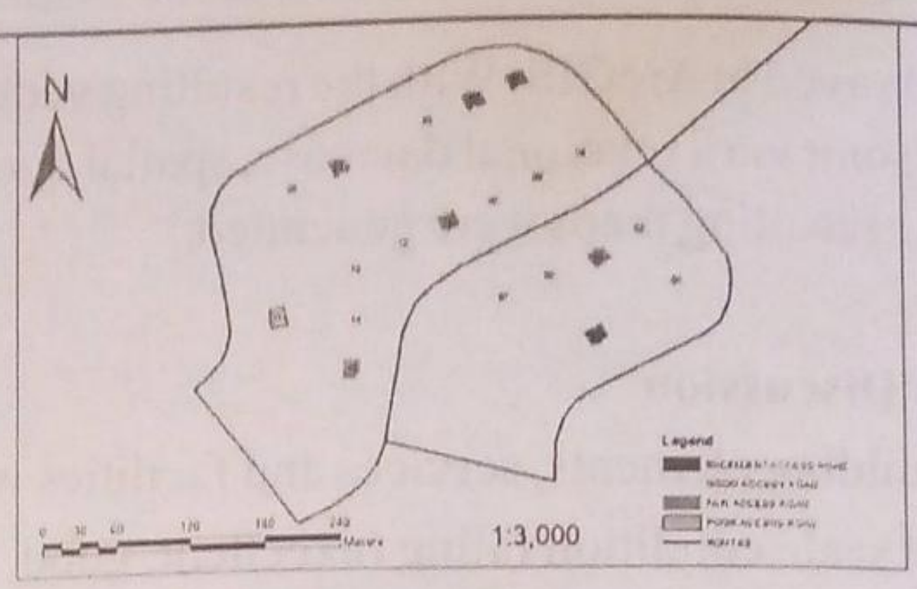

Figure 29.2f: Accessibility

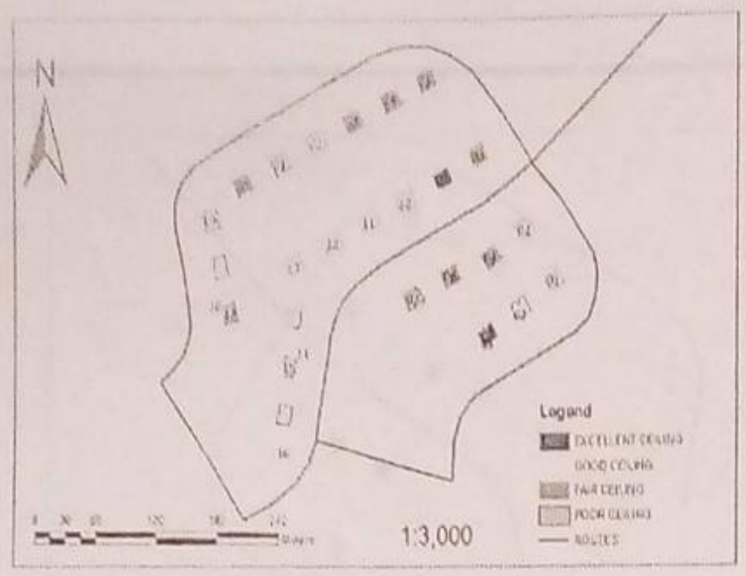

Figure 29.2g: ceiling condition

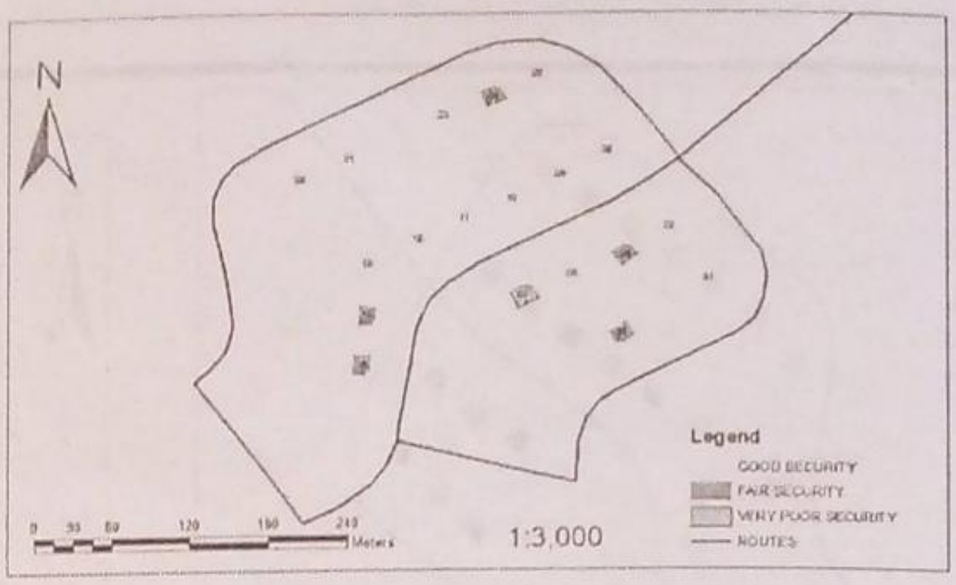

Figure 29.2h: Security perception

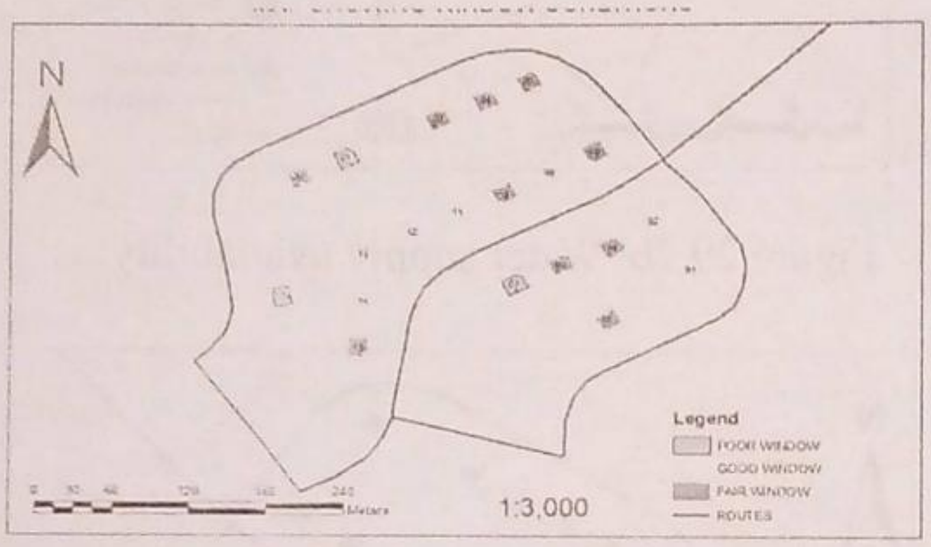

Figure 29.2i: Window condition

Source: *Field Survey (2016)*

From Figures 29.2a – 29.2i it can be deduced that 48% of the housing units within the estate have good external doors and floor conditions and about 4% of the houses have very poor external doors. 36% of the buildings have good roofs and 28% have poor roofs. A summary of the statistics of the percentage of buildings that fall under each of the categories is presented in Table 29.1 and further depicted by Figure 29.3.

Table 29.1: Percentage of buildings that fall within each rating condition

S/No	Building Factor	Rating condition					Total in %
		Excellent (%)	Good (%)	Fair (%)	Poor (%)	Very bad (%)	
1	External door	0	48	28	4	20	100
2	Internal door	0	20	56	4	20	100
3	window	0	28	40	12	20	100
4	floor	4	48	28	4	16	100
5	Internal wall	4	44	20	8	24	100
6	External wall	4	48	20	8	20	100
7	roof	8	36	28	8	20	100
8	ceiling	8	28	36	4	24	100
9	Access road	4	48	24	4	20	100
10	landscape	0	28	36	8	28	100
11	electricity	0	48	12	8	32	100
12	Water supply	4	28	12	0	56	100
13	security	0	52	20	4	24	100

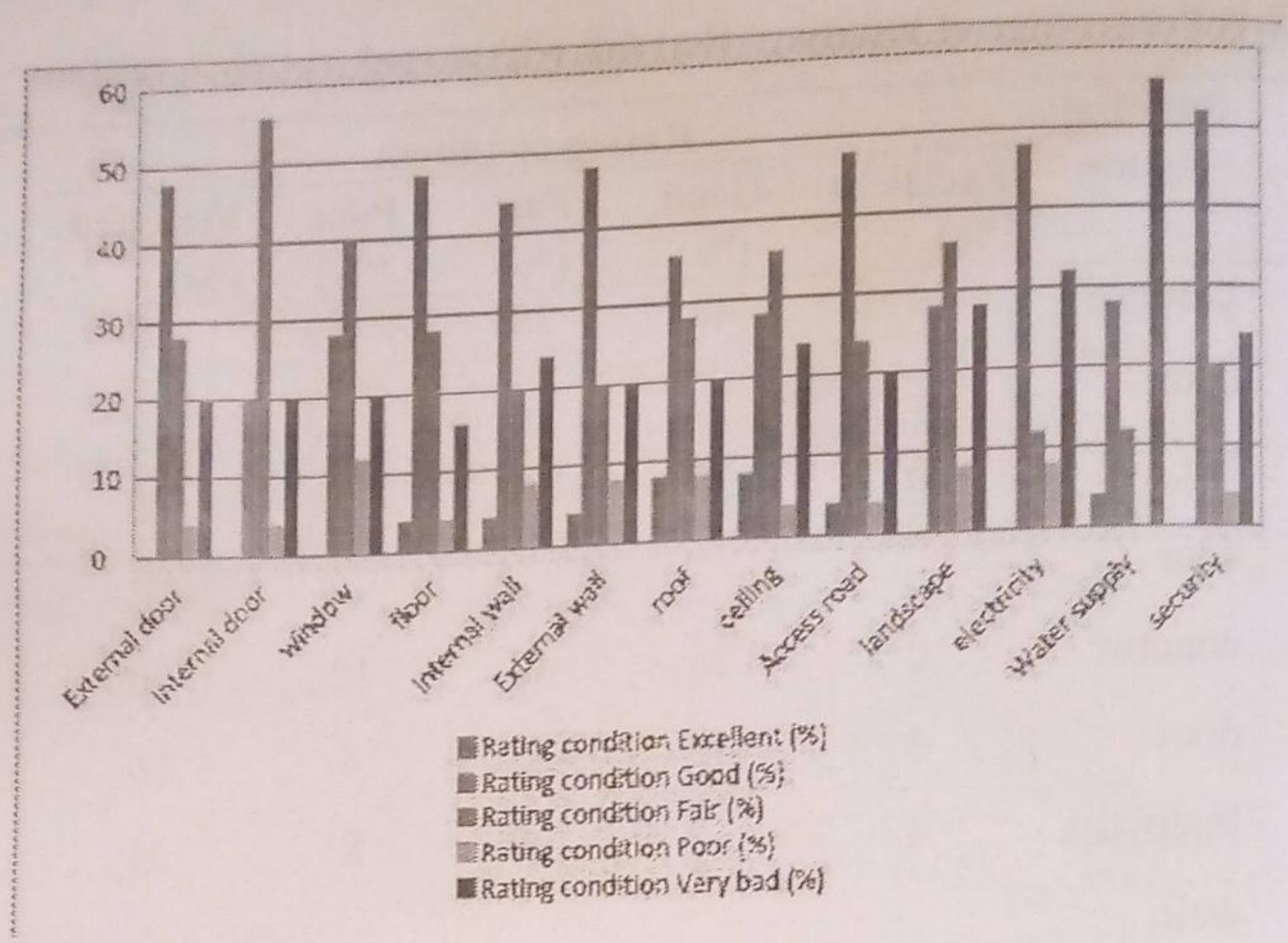

Figure 29.3: Bar chart for buildings that fall within each rating condition

It can be seen from Figure 29.3 that most of the buildings fall within excellent and fair conditions as less than 20% of the respondents scored the considered facility as either poor or very poor. Many of the services and building elements considered have been scored as either fair or good (satisfactory) except water supply, which about 56% of the respondents rated as very bad. Table 26.2 shows the overall suitability condition of all the houses as well as the performance of each housing unit based on the suitability criteria developed for the houses.

s/no	Suitability value	Suitability index	Remarks	House No
1	96	1	Suitable	4
2	94	2	Suitable	11
3	90	3	Suitable	5
4	88	4	Suitable	6
5	86	5	Suitable	2
6	83	6	Suitable	13

Table 20.2 Continued: Summary of Housing units suitability

s/no	Suitability value	Suitability index	Remarks	House No
7	82	7	Suitable	14
8	81	8	Suitable	1
9	81	8	Suitable	8
10	79	10	Suitable	10
11	78	11	Suitable	12
12	77	12	Suitable	9
13	74	13	Suitable	23
14	74	13	Suitable	24
15	68	15	Suitable	21
16	67	16	Suitable	20
17	65	17	Suitable	15
18	63	18	Suitable	25
19	59	19	Suitable	17
20	49	20	Not Suitable	7
21	0	21	Not Suitable	3
22	0	21	Not Suitable	16
23	0	21	Not Suitable	18
24	0	21	Not Suitable	19
25	0	21	Not Suitable	22

Conclusion

This study has shown the effectiveness of matrix manipulation rather than the conventional regression analysis for determination of building suitability status within an estate. GIS technique of data acquisition and retrieval has also been used in the study to create a functional database that could be useful for management and easy administration of the estate. The information in the database have been used to determine a suitability index for each building within the estate and it was discovered that 76% of the buildings within the estate have suitability values that are above average, based on the thirteen building elements, services and facilities considered.

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