IMPACT OF GEOGRAPHIC INFORMATION SYSTEM(GIS) ON PROPERTY VALUATION IN BENIN CITY, NIGERIA

BY

AIGBEKAEN IREDIA PRINCE

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DEPARTMENT OF ESTATE MANAGEMENT

FACULTY OF ENVIRONMENTAL SCIENCES

UNIVERSITY OF BENIN

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BEING A PROJECT DISSERTATION SUBMITTED TO THE DEPARTMENT OF ESTATE MANAGEMENT, FACULTY OF ENVIRONMENTAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE IN ESTATE MANAGEMENT (B.Sc.)

FEBRUARY, 2025

CERTIFICATION

We, certify that this work was carried out by **AIGBEKAEN IREDIA PRINCE** in the Department of Estate Management, University of Benin, Benin City, as adequate in scope and quality in partial fulfillment of the requirements for the award of Bachelor of Science Degree (BSc.) Of the university of Benin, Benin City.

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(External Supervisor)

03/04/2025

DECLARATION

I, **AIGBEKAEN IREDIA PRINCE**, certify that this project is entirely my own work and composition.

07/04/2025

AIGBEKAEN IREDIA PRINCE **DATE**

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DEDICATION

I dedicate this work to God Almighty, for His infinite mercies, guidance and protection throughout my study.

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ABSTRACT

Property valuation is a critical component of the real estate industry, influencing transactions, investment decisions, taxation, and urban planning. Traditional valuation methods often rely on subjective judgment, which can be time-consuming and prone to errors. This study examines the impact of Geographic Information Systems (GIS) on property valuation, using Benin City as a case study.

GIS integrates spatial data analysis with property valuation, enabling a more precise assessment of factors such as location, market trends, and environmental influences. The research employs a survey methodology, collecting data from estate surveyors and valuers to evaluate GIS adoption, its benefits, and the challenges hindering its implementation. Findings reveal that GIS enhances valuation accuracy by improving data integration, visualization, and spatial analysis. However, challenges such as high implementation costs, lack of trained personnel, and data inconsistencies hinder its widespread adoption.

The study concludes that GIS has the potential to revolutionize property valuation, provided that stakeholders address the identified barriers through investment in training, infrastructure, and policy support.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Property valuation is a critical component in the real estate industry, financial institutions, and various government agencies. It plays a pivotal role in activities such as property sales, mortgage lending, investment analysis, taxation, and legal disputes. Accurate property valuation ensures fair transactions, equitable taxation, and informed investment decisions (Ustaoglu & Williams, 2019). Traditional methods of property valuation often rely heavily on the expertise and judgment of valuers who consider numerous factors including location, physical characteristics of the property, market trends, and comparable sales data. These conventional methods, while foundational, can be labor-intensive, time-consuming, and subject to human error and bias. In recent decades, technological advancements have increasingly permeated various sectors, transforming traditional practices. One such technology is Geographic Information Systems (GIS), which has brought significant innovations to the field of property valuation. GIS is a powerful tool that integrates hardware, software, and data to capture, manage, analyze, and display geographically referenced information. This technology enables the visualization and analysis of spatial data, facilitating a more comprehensive and accurate understanding of the geographical context of properties (Almutairi & Mutanga, 2020).

The integration of GIS into property valuation offers several advantages. Firstly, GIS provides detailed spatial analysis capabilities, allowing valuers to incorporate a wide range of geographic factors into their assessments. Factors such as proximity to amenities, environmental conditions, land use patterns, and transportation networks can be systematically analyzed and visualized. This enhances the accuracy of valuations by

providing a more holistic view of the property's context (Doko & Denes, 2019). Also, GIS enables the efficient management and analysis of large datasets. Traditional property valuation methods often struggle with handling vast amounts of data, leading to potential inaccuracies. GIS technology, however, can process and analyze large datasets quickly and accurately, improving the efficiency and reliability of the valuation process. Additionally, GIS facilitates the integration of various data sources, such as cadastral maps, satellite imagery, and demographic information, further enriching the valuation process (Almutairi & Mutanga, 2020).

Moreover, GIS technology supports dynamic and interactive mapping, which enhances the visualization of property data. Valuers can create detailed maps that highlight important spatial relationships and trends, making it easier to communicate findings to clients and stakeholders. This visual representation of data not only aids in the valuation process but also improves transparency and understanding for all parties involved. Despite the clear benefits of GIS in property valuation, its adoption has been uneven (Ustaoglu & Williams, 2019). Many valuers continue to rely on traditional methods due to a lack of awareness, training, or access to GIS technology (Raza & Ali, 2020). Furthermore, there are challenges associated with the implementation of GIS, such as the need for accurate and up-to-date spatial data, the cost of acquiring and maintaining GIS software, and the technical expertise required to effectively use the technology. These barriers have hindered the widespread adoption of GIS in property valuation, necessitating a comprehensive evaluation of its impact and potential (Doko & Denes, 2019).

The relevance of GIS to property valuation extends beyond individual transactions. Accurate property valuations are essential for maintaining a stable real estate market, ensuring fair taxation, and supporting effective urban planning and development. Inaccurate valuations can

lead to distorted market conditions, financial losses, and inequitable tax burdens, highlighting the importance of improving valuation accuracy through innovative technologies like GIS (Ustaoglu & Williams, 2019). This study aims to explore the impact of GIS on property valuation accuracy, assessing how this technology can transform traditional valuation practices and contribute to more precise and reliable property assessments. By examining the capabilities and benefits of GIS, the study seeks to provide valuable insights for policymakers, real estate professionals, and technology developers, promoting the broader adoption of GIS and enhancing the overall accuracy and efficiency of property valuations.

1.2 Statement of the Research Problem

Accurate property valuation is fundamental to the real estate industry and related sectors. Inaccuracies in property valuations can lead to significant financial losses, unfair taxation, and distorted market conditions. Traditional valuation methods, relying heavily on the subjective judgment of valuers, are often limited by the availability and quality of data. These methods can be labour-intensive and inconsistent, leading to variations in property assessments. Peterson, and Miller (2019) evaluated the impact of GIS technology on property valuation, but this research was carried out in Canada making his findings not applicable to the Nigerian real estate industry, also Nwilo and Ifejika (2017) examined the impact of GIS on property valuation accuracy in Lagos, Nigeria and found that GIS has significant impact on property valuation but failed to examine the challenges and limitations of GIS application in property valuation; Jones and Smith (2018) investigated the role of GIS in property valuation accuracy in South Africa and found that GIS paly a fundamental role in property valuation accuracy but failed to examine the functionalities of GIS; Bujari and Martz (2019) studies GIS-based automated valuation models. A case study of residential property valuation in Canada which found that GIS-based automation is critical in effectively valuating

residential property but however failed to tell of the capabilities and functionalities of GIS in relation to property valuation; Abidoye and Chan (2017) examined Modelling property values in Nigeria using Geographic Information Systems (GIS) and found that GIS is an effective tool in Modelling property values in Nigeria due to its vast ability in automating property valuation, however the study failed to show its functioning which is a gap this study intends to fill. Lastly, Jayanthi and Maheswari (2020) examined GIS-based automated valuation models for residential properties in India and found that GIS automation as compared to traditional valuation method is more effective and efficient, but the study failed to examine the factors influencing GIS-based automated valuation effectiveness. All these studies did not take a critical look at the capabilities and functionalities of GIS in relation to property valuation, but focused more on GIS impact on real estate transactions. Also, the findings of these researches may not be applicable to the case of Benin City which has a different property market terrain. Hence, this present study tens to look at the property market in Benin City.

The integration of GIS into the property valuation process has the potential to address these challenges by providing more accurate, consistent, and efficient valuations. Despite the recognized benefits of GIS, its adoption in property valuation has been uneven, and there is a lack of comprehensive research on its impact on valuation accuracy. This study aims to fill this gap by investigating the extent to which GIS can improve property valuation accuracy and identifying the factors that influence its effectiveness. It is against this backdrop that this study is carried out to evaluate the impact of Geographic Information Systems (GIS) on property valuation accuracy, using Benin City property market as a case study.

1.3 Aim and Objectives of the Study

The aim of this study is to evaluate the impact of Geographic Information Systems (GIS) on property valuation accuracy with a view to ascertaining its relevance to real estate professionals. The specific objectives are to:

1. Analyze the capabilities and functionality of GIS in relation to property valuation.
2. Identify the factors influencing GIS effectiveness on valuation accuracy.
3. Ascertain the benefits of GIS application in property valuation.
4. To identify the challenges and limitations associated with the implementation of GIS in property valuation.

1.4 Research Questions

This study seeks to answer the following research questions:

1. What are the capabilities and functionalities of GIS that can be applied to property valuation?
2. What are the factors influencing the effectiveness of GIS on valuation accuracy?
3. What are the benefits of GIS application in property valuation?
4. What are the challenges and limitations in implementing GIS for property valuation?

1.5 Significance of the Study

This study is significant for several reasons. First, it provides a comprehensive analysis of how GIS technology can be utilized to improve property valuation accuracy. By highlighting

the benefits and challenges of GIS, the study can inform Estate Surveyors and Valuers on best practices for integrating GIS into valuation processes.

Secondly, the findings of this study can contribute to the body of knowledge in the field of property valuation and GIS, offering empirical evidence on the effectiveness of GIS in enhancing valuation accuracy. This can lead to further research and development in this area, promoting innovation and advancement in property valuation methodologies.

Finally, by identifying strategies to overcome the challenges associated with GIS implementation, the study can support the broader adoption of GIS technology, leading to more accurate and reliable property valuations. This can have positive implications for the real estate market, financial institutions, and government agencies, ensuring fair and equitable property assessments.

1.6 Scope of the Study

The scope of this study includes an examination of property valuation practices and the integration of GIS technology. The study focuses on residential and commercial property valuations in urban and suburban areas, where GIS data is most readily available and applicable. The geographical scope is limited to Benin City real estate market, providing a representative sample for analysis

1.7 Study Area

Edo state lies approximately between longitudes 6.6342°N and 5.9304°E, located in the southern part of Nigeria about 40 miles from the Gulf of Guinea while its Northern and Southern boundaries are shared with Kogi and Delta State, while Ondo State to the Western side boundary. Edo State is a diverse and culturally rich region located in southern Nigeria, known for its historical significance, vibrant culture, and economic potential. Edo State is

home to the ancient Benin Kingdom, renowned for its historical artifacts, artworks, and traditional institutions. The Benin Kingdom, with its rich cultural heritage and artistic achievements, holds a prominent place in Nigerian history and continues to influence the cultural identity of the region.

The capital city of Edo State is Benin City, one of Nigeria's oldest cities and a major cultural and economic hub in the region. Benin City is known for its bustling markets, vibrant nightlife, and landmarks such as the Benin National Museum, which houses a significant collection of artifacts from the Benin Kingdom. It boasts a diverse economy with agriculture, trade, manufacturing, and services sectors playing pivotal roles. Agriculture is a primary economic activity, with crops like oil palm, rubber, cocoa, and cassava being major contributors to the state's economy. The state also has significant mineral resources, including limestone, granite, and crude oil. Edo State is home to several notable educational institutions, including the University of Benin (UNIBEN), one of Nigeria's leading universities, and the Ambrose Alli University in Ekpoma. These institutions contribute to the educational advancement and human capital development of the state and the broader Nigerian society.

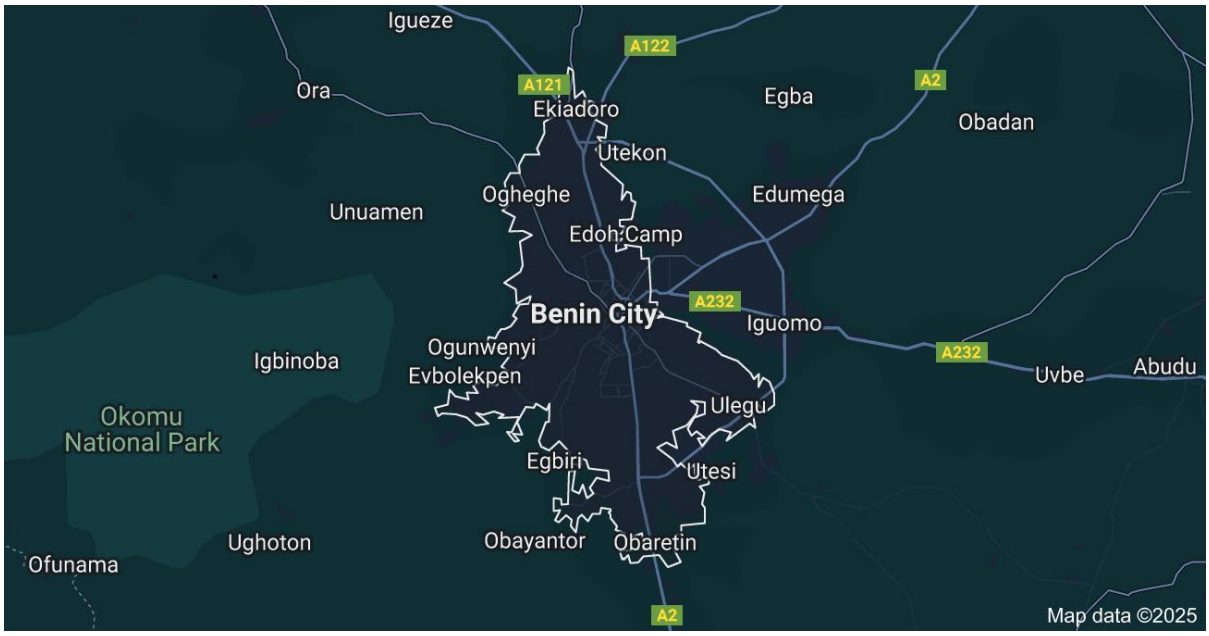
Fig 1.1: Map of Edo State (*Source: Nigeria infopedia*)

Benin City is the capital, and largest city of Edo state in southern Nigeria and is the fourth largest city in Nigeria after Lagos, Kano and Ibadan with the total population of 1,782,000 as of 2021. It is situated approximately 40 kilometers (25 mi) north of the Benin River and 320 kilometers (200 mi) by road east of Lagos. Benin City is the center of Nigeria's rubber industry, and oil production is also a significant industry. Benin City is made up of four local government areas which are Oredo, Egor, Ikpoba Okha and Ovia North East. The

administrative headquarter of the state is located in Oredo local government area which is also home to the prestigious ancient throne of the Oba of Benin, Oba Eware Ogidigan II (Doko & Denes, 2019).

The real estate market in Benin City is characterized by diverse opportunities and growing demand across residential, commercial, and industrial sectors. Residential real estate development is thriving, driven by a burgeoning population and urbanization trends, with areas like GRA (Government Reservation Area), Ikpoba Hill, and G.R.A Extension witnessing significant growth in housing projects ranging from apartments to detached homes. Commercial real estate, particularly in central business districts and strategic locations along major roads like Ring Road, Sapele Road and Airport Road, is also expanding to accommodate the rising demand for office spaces, retail outlets, and hospitality facilities. Industrial real estate is poised for growth, supported by the state's economic activities in manufacturing, agriculture, and trade.

Fig 2: Map of Benin City. **Source:** (*Source: Google Maps*)



1.8 Definition of Key Terms

Geographic Information Systems (GIS): A system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data.

Property Valuation: The process of determining the value of a property, typically for purposes such as taxation, sales, mortgage lending, and investment analysis.

Spatial Data: Information about the physical location and shape of geometric objects, which can be mapped or analyzed geographically.

Traditional Valuation Methods: Property valuation approaches that rely on manual data collection, analysis, and the subjective judgment of valuers.

1.9 Layout of the Study

This study is organized into five chapters. Chapter one provides an introduction to the topic, including the background, statement of the problem, objectives, research questions, significance, scope, and definitions of key terms. Chapter two reviews the relevant literature on property valuation and GIS technology, highlighting previous research and theoretical frameworks. Chapter three outlines the research methodology, including the research design, data collection methods, and analytical techniques. Chapter four presents the findings and analysis of the data collected. Finally, Chapter five offers conclusions and recommendations based on the study's findings, discussing implications for practice and future research directions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Preamble

This section discussed the impact of Geographic Information Systems (GIS) on property valuation accuracy. Relevant literature will be reviewed under the following sub-headings; Property valuation in Nigeria, The traditional method of valuation and its methods, Geographic information system and its various aspects, Application of GIS to property valuation, Benefits, Challenges and Limitations of GIS, Theoretical review and Empirical review of related literatures.

2.2 Property Valuation in Nigeria

Property valuation is the process of estimating the price at which a property would trade in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus (Harjula & Hietala, 2017). According to Doko and Denes (2019) defined Property valuation as determining the value of a property to a specific investor based on their individual investment criteria, expectations, and requirements, which may include considerations of future income, tax benefits, and personal usage. Property valuation in Nigeria is a critical aspect of the real estate market, providing essential data for various stakeholders, including investors, property owners, financial institutions, and government agencies. The valuation process in Nigeria involves determining the market value of a property, which is influenced by a range of factors such as location, size, condition, and the prevailing economic environment. This valuation is crucial for transactions like buying, selling, leasing, and financing properties, ensuring that parties involved have a fair and accurate understanding of a property's worth (Almutairi & Mutanga, 2020).

The methods used in property valuation in Nigeria typically include the sales comparison approach, the cost approach, and the income approach. The sales comparison approach relies on recent sales of similar properties in the same area to estimate value. The cost approach involves calculating the cost of replacing the property, considering depreciation, while the income approach evaluates the potential income a property can generate (Harjula & Hietala, 2017). These methods are often employed by professional valuers who are registered and regulated by the Nigerian Institution of Estate Surveyors and Valuers (NIESV). From a theoretical perspective, property valuation can be defined as the estimation of the true worth of a property based on fundamental analysis, which includes factors like location, condition, future earning potential, and overall economic conditions, independent of the current market price (Bhatt & Chakraborty, 2018).

Several challenges impact property valuation in Nigeria. One significant challenge is the lack of comprehensive and up-to-date property data, which can hinder accurate valuations. Additionally, economic instability and fluctuating exchange rates can affect property values and market confidence. Despite these challenges, technological advancements and increased access to data are gradually improving the accuracy and reliability of property valuations. Almutairi and Mutanga (2020) stated that property valuation in Nigeria is an evolving field that plays a pivotal role in the real estate market. As the country continues to develop and modernize, the importance of accurate property valuation becomes even more pronounced, providing a foundation for informed decision-making and sustainable growth in the real estate sector.

2.2.1 Traditional Method of Valuation

The traditional method of valuation, often referred to as the comparative or market approach, is a widely used technique for determining the value of a property by comparing it with

similar properties that have recently been sold in the same area. This method relies heavily on the principle of substitution, which asserts that a rational buyer would not pay more for a property than the cost of acquiring a comparable alternative. By analyzing the sale prices of similar properties, valuers can estimate the likely selling price of the property being valued (Chica-Olmo & Fernandez-Aviles, 2020). This valuation method involves several key steps. Firstly, a thorough market analysis is conducted to identify comparable properties, often referred to as "comps." These properties should be similar in terms of location, size, condition, and features. The valuer then adjusts the sale prices of these comparable properties to account for any differences between them and the subject property. Adjustments may be made for factors such as the number of bedrooms, the presence of amenities like swimming pools or garages, and the overall condition of the property (Harjula & Hietala, 2017).

One of the main advantages of the traditional method of valuation is its reliance on actual market data, which can provide a realistic and current estimate of a property's value. This approach is particularly effective in active and stable markets where there is an abundance of comparable sales data. It is also straightforward and easy to understand, making it a popular choice among property buyers, sellers, and real estate professionals. However, the traditional method of valuation also has its limitations (Chica-Olmo & Fernandez-Aviles, 2020). In markets where comparable sales are scarce or the properties are highly unique, it can be challenging to find appropriate comparables, leading to less accurate valuations (Bhatt & Chakraborty, 2018). Additionally, this method may not fully account for future market trends or the intrinsic value of the property that may not be reflected in recent sales data. Despite these limitations, the traditional method remains a cornerstone of property valuation practices due to its practical application and empirical basis (Ozdenerol & Williams, 2018).

The traditional methods of valuation in real estate are widely utilized to determine the value of properties for various purposes, including buying, selling, leasing, financing, and taxation (Peterson & Miller, 2019). These methods rely on historical data, market trends, and comparable properties to estimate a property's worth. The main traditional methods of valuation are: The market approach, the cost approach, the income approach, residual approach and the profits method.

The Sales Comparison Approach (Market Approach) is the most common method and involves comparing the property in question with similar properties that have recently been sold in the same area. The valuer identifies comparable properties, known as "comps," and adjusts their sale prices to account for differences in size, condition, location, and other relevant features. The adjusted prices provide a basis for estimating the value of the subject property. This approach works best in active markets with plenty of recent sales data (Seker & Dolmaz, 2018). The Cost Approach estimates the value of a property by calculating the cost to replace or reproduce the structure, minus any depreciation, plus the value of the land. The cost approach involves determining the current cost of constructing a similar building and then subtracting depreciation due to wear and tear, functional obsolescence, and other factors. The land value is then added to this depreciated cost. This approach is particularly useful for new or unique properties where comparable sales are scarce (Bhatt & Chakraborty, 2018).

The Income Approach is used primarily for income-producing properties such as rental buildings, commercial properties, and investment real estate. It involves estimating the present value of future income streams generated by the property. The income approach includes two main techniques: the direct capitalization method and the discounted cash flow (DCF) method. The direct capitalization method divides the property’s net operating income

(NOI) by a capitalization rate to determine its value, while the DCF method involves projecting future cash flows and discounting them back to their present value (Tso & Ho, 2017). Residual Method is often used for properties with development potential. It involves estimating the potential gross development value (GDV) of a property after completion of a proposed development and then subtracting development costs, including construction, financing, and professional fees, to arrive at the residual value. This method helps developers determine the value of land or properties that can be developed or redeveloped (Ustaoglu & Williams, 2019).

The Profits Method is used for specialized properties that are not frequently sold on the open market, such as hotels, nursing homes, and pubs. It involves assessing the value of the property based on the profits it generates. The valuer examines the business's financial statements to determine the gross profit, deducts operating expenses to arrive at the net profit, and then applies a multiplier to estimate the property's value (Bhatt & Chakraborty, 2018). Each of these traditional methods of valuation has its strengths and limitations, and the choice of method depends on the type of property, the purpose of the valuation, and the availability of data. Often, valuers use a combination of these methods to cross-verify and ensure the accuracy of their valuation estimates.

2.3 Geographic Information Systems (GIS)

Geographic Information Systems (GIS) are advanced systems that facilitate the collection, storage, analysis, and presentation of spatial or geographic data. At its core, GIS integrates hardware, software, and data to allow users to visualize, interpret, and understand spatial patterns, relationships, and trends. This technology is crucial in various fields, including urban planning, environmental management, transportation, and public health, providing essential insights that inform decision-making processes (Del Giudice & De Paola, 2018).

GIS can handle and manipulate different types of spatial data, including vector data, which represents geographic features such as points, lines, and polygons, and raster data, which comprises grid-based data like aerial photographs and satellite imagery. By combining these data types, GIS can create detailed maps that display complex spatial information in an accessible format. For instance, urban planners can use GIS to map infrastructure projects, environmental scientists can monitor land use changes, and public health officials can track disease outbreaks (Bujari & Martz, 2019).

The concept of GIS also includes a range of analytical tools that enable sophisticated spatial analysis. These tools can examine spatial relationships, such as proximity, connectivity, and overlay, to provide deeper insights into geographic phenomena. For example, GIS can be used for network analysis to optimize transportation routes or for suitability analysis to identify the best locations for new facilities. This analytical capability makes GIS a valuable tool for solving spatial problems and making informed decisions (Chica-Olmo & Fernandez-Aviles, 2020). Moreover, GIS is increasingly integrated with other technologies like remote sensing, Global Positioning Systems (GPS), and Internet of Things (IoT) devices, enhancing its functionality and application scope. Remote sensing offers high-resolution imagery, GPS provides precise location data, and IoT devices supply real-time information from the field. The combination of these technologies with GIS enables dynamic and real-time spatial analysis, expanding its potential uses and benefits. Abidoye and Chan (2017) opined that Geographic Information Systems (GIS) are powerful tools for managing and analyzing spatial data, offering significant benefits across numerous sectors. By providing a comprehensive framework for understanding geographic information, GIS helps professionals make more informed decisions, leading to more efficient and effective planning and management practices (Doko & Denes, 2019).

2.3.1 Various Aspects of GIS

Geographic Information Systems (GIS) encompass a range of aspects that contribute to their functionality and application. These aspects include data acquisition, data management, spatial analysis, visualization, and integration with other technologies. Each of these components plays a critical role in the overall effectiveness of GIS in addressing spatial problems and providing insightful information for decision-making.

Data Acquisition: The foundation of any GIS is its data, which can be sourced from various methods including satellite imagery, aerial photography, GPS surveys, and existing maps. Data acquisition involves collecting accurate and up-to-date spatial and attribute data, which represent the geographic location and characteristics of features on the Earth's surface. This data can be in the form of vector data (points, lines, and polygons) or raster data (gridded data such as digital elevation models and satellite images). Ensuring high-quality data is crucial as it impacts the accuracy and reliability of GIS analyses and outputs (Parker & Leung, 2017).

Data Management: Managing large volumes of spatial data requires robust database systems and software tools. GIS data management involves storing, organizing, and maintaining spatial and attribute data in a way that allows for efficient retrieval and manipulation. This includes using spatial databases, such as PostgreSQL with PostGIS extension, and managing metadata to ensure data provenance and quality. Data management also involves implementing data standards and protocols to facilitate data sharing and interoperability between different GIS platforms and users.

Spatial Analysis: One of the core functions of GIS is spatial analysis, which allows users to examine the relationships, patterns, and trends in spatial data. Spatial analysis techniques include overlay analysis, buffering, spatial querying, and network analysis. For example,

overlay analysis can combine multiple layers of data to identify areas of interest, such as potential sites for new infrastructure. Buffering can determine the impact zones around features, such as the areas affected by a new road. Network analysis can optimize routes and connectivity in transportation planning. These analytical capabilities enable users to derive meaningful insights and support data-driven decision-making (Doko & Denes, 2019).

Visualization: GIS excels in visualizing spatial data through the creation of maps, 3D models, and interactive web applications. Effective visualization helps communicate complex spatial information in a clear and understandable manner. GIS software offers a range of tools for customizing map elements, such as symbols, colors, and labels, to enhance the visual representation of data (Raza & Ali, 2020). 3D visualization provides a more realistic view of geographic features and can be particularly useful in urban planning and environmental assessments. Interactive web GIS applications allow users to explore and interact with spatial data in real-time, making GIS more accessible to a broader audience (Chica-Olmo & Fernandez-Aviles, 2020).

Integration with Other Technologies: GIS is increasingly integrated with other technologies, enhancing its functionality and expanding its applications. Remote sensing technologies provide high-resolution imagery and data for large-scale environmental monitoring and analysis. GPS technology enables precise location tracking and real-time data collection, which is essential for applications like fleet management and field surveys (Nwilo & Ifejika, 2017). The Internet of Things (IoT) involves connecting physical devices to the internet, allowing for real-time data streaming into GIS for applications such as smart city management and environmental monitoring. The integration of GIS with machine learning and artificial intelligence (AI) further enhances its analytical capabilities, enabling predictive modeling and advanced pattern recognition (Ozdenerol & Williams, 2018).

Applications Across Various Sectors: GIS applications span a wide range of sectors, demonstrating its versatility and importance. In urban planning, GIS is used for land use planning, infrastructure development, and zoning analysis. In environmental management, it helps monitor natural resources, assess environmental impacts, and manage conservation efforts. In public health, GIS tracks disease outbreaks, maps health services, and analyzes environmental health risks. In transportation, it optimizes route planning, manages traffic systems, and supports logistics. Additionally, GIS is vital in emergency management for disaster preparedness, response, and recovery planning (Doko & Denes, 2019).

User Interfaces and Accessibility: Modern GIS software offers user-friendly interfaces that make it accessible to both technical experts and non-experts. Desktop GIS applications like ArcGIS and QGIS provide comprehensive tools for advanced spatial analysis and data management. Web-based GIS platforms, such as Google Earth and Esri's ArcGIS Online, offer accessible mapping and visualization tools for a broader audience. Mobile GIS applications enable field data collection and real-time data access, supporting various field-based activities (Luo & Wang, 2018).

Jones and Smith (2018) asserted that Geographic Information Systems (GIS) integrate multiple aspects that contribute to their powerful capabilities in managing, analyzing, and visualizing spatial data. The seamless integration of data acquisition, management, spatial analysis, visualization, and other technologies makes GIS an invaluable tool across numerous industries, facilitating informed decision-making and efficient resource management.

2.4 Application of GIS to Property Valuation

Geographic Information Systems (GIS) play a crucial role in property valuation by enhancing the accuracy, efficiency, and comprehensiveness of the valuation process. GIS integrates

spatial data with various property attributes, enabling valuers to analyze and visualize properties in relation to their geographic context. This capability is particularly valuable in identifying factors that influence property values, such as location, accessibility, neighborhood characteristics, and proximity to amenities and services (Lindberg & Håkansson, 2017). One of the primary applications of GIS in property valuation is in the sales comparison approach. Valuers can use GIS to map and analyze recent sales data of comparable properties within a specific geographic area. By overlaying property sales data on maps, valuers can identify trends and patterns that may impact property values, such as clustering of high-value properties or areas experiencing rapid development. GIS also allows for the spatial filtering of comparable properties based on criteria like distance from the subject property, ensuring that only the most relevant comparables are considered in the valuation process.

Kuhlman and Barrett (2018) stated that GIS also enhances the cost approach to property valuation. By integrating spatial data on land use, zoning, and building regulations, GIS helps valuers estimate land values more accurately. Valuers can analyze the spatial distribution of land values across different zones and account for variations in land prices due to factors like location desirability and permitted land uses. Additionally, GIS can assist in calculating construction costs by providing access to spatial data on construction activity, material costs, and labor rates within different regions. In the income approach, GIS facilitates the analysis of income-generating properties by incorporating spatial data on rental rates, occupancy levels, and market demand. Valuers can use GIS to map rental properties and analyze their spatial distribution in relation to factors like employment centers, transportation networks, and commercial hubs. This spatial analysis helps in identifying areas with higher rental demand and potential for income growth. GIS also supports the visualization of market trends,

enabling valuers to project future income streams and assess the long-term viability of income-generating properties (Doko & Denes, 2019).

Furthermore, GIS is instrumental in identifying and analysing the impact of environmental and infrastructural factors on property values. For example, GIS can map flood zones, earthquake-prone areas, and other environmental hazards, allowing valuers to assess the risk associated with properties in these areas. Similarly, GIS can analyze the proximity of properties to infrastructure projects like new highways, public transportation, or utility services, which can significantly influence property values. By providing a spatial context to these factors, GIS helps valuers make more informed decisions and provide accurate valuations (Chica-Olmo & Fernandez-Aviles, 2020).

In addition to enhancing traditional valuation methods, GIS also supports advanced analytical techniques such as spatial modeling and geostatistical analysis. These techniques enable valuers to identify spatial correlations and predict property values based on multiple influencing factors. For instance, GIS-based spatial regression models can analyze the relationship between property values and variables like population density, crime rates, and school quality. These models provide a more comprehensive understanding of the factors driving property values and help in developing more accurate valuation estimates (Doko & Denes, 2019). Hence, the application of GIS in property valuation offers significant benefits by providing a spatial dimension to the valuation process. GIS enhances the accuracy and reliability of valuations by integrating various data sources and enabling detailed spatial analysis. It supports the identification of trends, patterns, and influencing factors that may not be apparent through traditional valuation methods alone. As a result, GIS is an invaluable tool for property valuers, helping them deliver more precise and informed valuations in a rapidly changing real estate market (Li & Sun, 2020).

2.5 Potential Benefits of GIS

The potential benefits of Geographic Information Systems (GIS) are vast and extend across numerous sectors, offering significant advantages in terms of efficiency, accuracy, and decision-making capabilities. One of the primary benefits of GIS is its ability to integrate and manage large volumes of spatial data from various sources. This integration enables organizations to maintain a centralized database of geographic information, which can be easily accessed, updated, and shared among different departments and stakeholders. By streamlining data management processes, GIS reduces redundancy, enhances data consistency, and ensures that all users have access to the most current and accurate information.

GIS also enhances spatial analysis and visualization capabilities, allowing users to identify patterns, trends, and relationships that are not immediately apparent through traditional data analysis methods. For instance, in urban planning, GIS can be used to analyze population density, land use, and infrastructure networks, helping planners make informed decisions about zoning, transportation, and public services. In environmental management, GIS can map and monitor natural resources, track changes in land cover, and assess the impacts of human activities on ecosystems. These analytical capabilities enable more comprehensive and evidence-based decision-making, ultimately leading to better outcomes for communities and the environment (Li & Sun, 2020).

Another significant benefit of GIS is its ability to improve operational efficiency and resource management. In sectors such as utilities and transportation, GIS helps organizations manage their infrastructure assets more effectively. For example, utility companies can use GIS to map and monitor the condition of their networks, plan maintenance activities, and optimize service delivery. Transportation agencies can analyze traffic patterns, plan new routes, and

manage logistics more efficiently using GIS data. By providing a spatial context to operational activities, GIS helps organizations allocate resources more strategically, reduce costs, and enhance service quality.

According to Jones and Smith (2018), GIS also plays a critical role in emergency management and public safety. By providing real-time spatial data and analysis, GIS supports emergency response efforts, helping authorities assess the extent of disasters, identify affected areas, and allocate resources for relief operations. GIS can also be used to develop hazard maps and risk assessments, informing disaster preparedness and mitigation strategies. For public safety agencies, GIS enables the analysis of crime patterns, the deployment of law enforcement resources, and the planning of community safety initiatives. The ability to visualize and analyze spatial data in real-time enhances situational awareness and enables more effective response and recovery efforts (Li & Sun, 2020).

Furthermore, GIS contributes to enhanced communication and collaboration among stakeholders. By providing interactive and visually engaging maps and applications, GIS helps convey complex spatial information in a more accessible and understandable format. This capability is particularly valuable in public engagement and participatory planning processes, where stakeholders need to visualize and understand the implications of proposed projects and policies. GIS-based web applications and dashboards allow for real-time data sharing and collaboration, fostering transparency and informed decision-making (Kamara & Cooper, 2017).

In addition to these sector-specific benefits, GIS supports innovation and new applications through its integration with emerging technologies. The combination of GIS with technologies such as remote sensing, GPS, and the Internet of Things (IoT) enables more

dynamic and real-time data collection and analysis. For example, the integration of GIS with IoT sensors can provide real-time monitoring of environmental conditions, traffic flows, or utility networks (Jayanthi & Maheswari, 2020). The use of machine learning and artificial intelligence (AI) in GIS can enhance predictive modeling and automate complex spatial analyses. These innovations expand the potential applications of GIS and enable more proactive and data-driven approaches to problem-solving. Ji and Li (2019) asserted that the potential benefits of GIS are extensive and multifaceted, encompassing improved data management, enhanced spatial analysis and visualization, increased operational efficiency, better emergency management, and more effective communication and collaboration. By providing a comprehensive framework for understanding and managing spatial information, GIS empowers organizations to make more informed decisions, optimize resources, and address complex challenges across various sectors (Li & Sun, 2020).

2.6 Challenges and Limitation of GIS

Geographic Information Systems (GIS) offer numerous benefits while having several challenges and limitations that organizations and users need to consider. One of the primary challenges of GIS is data quality and accuracy. GIS relies heavily on spatial data, which must be current, reliable, and consistent to produce accurate analyses and meaningful results. However, acquiring high-quality spatial data can be costly and time-consuming, and inconsistencies in data formats or standards can lead to errors in analysis. Maintaining data quality requires ongoing validation, updating, and adherence to data management best practices, which can be resource-intensive for organizations.

Interoperability and data integration pose another significant challenge for GIS users. Spatial data often originates from multiple sources and formats, making it challenging to integrate and analyze seamlessly within GIS platforms. Different data standards, file formats, and

coordinate systems can hinder data interoperability and compatibility between GIS systems and applications. This fragmentation can limit the ability of organizations to leverage the full potential of their spatial data and may require specialized expertise to overcome technical barriers to integration.

Technical complexity and usability issues can also present challenges for GIS implementation and adoption. As modern GIS software become more user-friendly, mastering advanced spatial analysis techniques and interpreting complex GIS outputs often requires specialized training and expertise. Small organizations or non-technical users may find it challenging to navigate GIS interfaces, perform advanced spatial queries, or customize maps and applications according to their specific needs. Overcoming these usability barriers may require investing in training programs or hiring skilled GIS professionals, which can be a barrier for some organizations (Jayanthi & Maheswari, 2020).

Another limitation of GIS lies in its potential for oversimplification or abstraction of spatial phenomena. GIS models and analyses are based on simplifying assumptions and generalizations about spatial relationships and processes. These simplifications may not always capture the full complexity of real-world conditions or dynamics, leading to inaccuracies or biases in GIS outputs (Bujari & Martz, 2019). For example, spatial interpolation techniques used to estimate values between sampled data points may oversimplify spatial variability, resulting in interpolated surfaces that do not accurately reflect local conditions.

Furthermore, the scalability and cost-effectiveness of GIS implementations can be challenging for organizations, particularly for large-scale or enterprise-wide deployments. Scaling GIS infrastructure to accommodate growing data volumes, user demands, and

analytical capabilities may require significant investments in hardware, software licenses, and IT infrastructure (Gopal & Kumar, 2020). Additionally, ongoing maintenance, upgrades, and support costs can contribute to the total cost of ownership of GIS systems over time. For smaller organizations or those with limited budgets, these costs can pose barriers to adopting and maintaining GIS technologies effectively (Doko & Denes, 2019).

Lastly, ethical and privacy concerns related to GIS data usage and dissemination represent a growing challenge for organizations and governments. GIS data often includes sensitive information about individuals, communities, or protected environments, raising concerns about data privacy, security breaches, and unauthorized access. Ensuring data confidentiality, anonymity, and compliance with data protection regulations (such as GDPR) is essential for maintaining public trust and ethical standards in GIS applications (Jayanthi & Maheswari, 2020).

2.7 Theoretical Review

This study will consider the spatial data quality theory as it is the most relevant. The theory is highly pertinent because it directly addresses the core elements that GIS influences in property valuation—namely, the accuracy, precision, and reliability of spatial data. Spatial Data Quality Theory emphasizes the importance of data accuracy and precision. In property valuation, the accurate representation of property characteristics such as location, proximity to amenities, and environmental factors is crucial. GIS significantly enhances this accuracy by providing precise geospatial data. For instance, detailed satellite imagery and precise geographic coordinates allow valuers to make more accurate assessments of property

boundaries, neighborhood attributes, and accessibility. By reducing errors associated with manual data collection and outdated maps, GIS ensures that property valuations are based on the most current and precise information available (Gatheru & Nyika, 2015).

One of the core principles of Spatial Data Quality Theory is the integration of multiple data sources. GIS excels in this area by combining various datasets, including cadastral maps, demographic data, environmental assessments, and market trends. This comprehensive integration allows for a more holistic view of the factors influencing property values. For example, the impact of new infrastructure projects, environmental hazards, or changes in zoning laws can be incorporated into the valuation process, providing a more nuanced and accurate assessment. The theory's focus on interoperability and standardization ensures that these diverse datasets can be seamlessly integrated and analyzed, enhancing the overall quality and reliability of the valuation (Bhatt & Chakraborty, 2018).

Spatial Data Quality Theory also includes robust methodologies for detecting and correcting errors in spatial data. GIS tools are equipped with capabilities for spatial data validation, error detection, and correction, which are essential for maintaining the integrity of the data used in property valuations. For example, inconsistencies in property boundaries or discrepancies in land use classifications can be identified and corrected using GIS, ensuring that the data underlying the valuation is accurate and reliable. This error management process is critical in producing trustworthy property valuations, as it minimizes the risk of inaccuracies that could arise from flawed or outdated data.

The principles of comprehensive data management, as advocated by Spatial Data Quality Theory, are essential for leveraging GIS in property valuation. GIS systems allow for the efficient storage, organization, and retrieval of large volumes of spatial data. This capability

ensures that valuers have access to comprehensive datasets that cover all relevant aspects of property valuation. For instance, GIS can store historical sales data, environmental impact reports, and demographic trends, providing a rich dataset for analysis. The ability to manage and analyze this data effectively enhances the accuracy and reliability of property valuations. Hence, Spatial Data Quality Theory provides a robust and relevant framework for understanding and enhancing the impact of GIS on property valuation accuracy (Gatheru & Nyika, 2015).. By focusing on data accuracy, integration, interoperability, and error management, this theory aligns perfectly with the strengths and capabilities of GIS. It ensures that property valuations are based on high-quality, reliable data, leading to more precise and trustworthy assessments. Therefore, Spatial Data Quality Theory is the most suitable theoretical foundation for exploring the impact of GIS on property valuation accuracy.

2.8 Empirical Review

Droj, Kwartnik-Pruc and Droj (2024) carried out a comprehensive overview regarding the impact of GIS on property valuation. This study draws on extensive academic literature comprising 103 research articles published between 1993 and January 2024 to shed light on the multifaceted application of GISs in real estate valuation. In particular, three main areas are addressed; The hedonic models, artificial intelligence (AI) and mathematical appraisal models. This synthesis emphasizes the interdependence of numerous societal challenges and highlights the need for interdisciplinary collaboration to address them effectively. In addition, this study provides a repertoire of methodologies that underscores the potential of advanced technologies, including artificial intelligence, GISs, and satellite imagery, to improve the subjectivity of traditional valuation approaches and thereby promote greater accuracy and productivity in real estate valuation. By integrating GISs into real estate valuation methodologies, stakeholders can navigate the complexity of urban landscapes with greater

precision and promote equitable valuation practices that are conducive to sustainable urban development.

Wyatt (2016) examined using a geographical information system for property valuation. Property valuers in England and Wales face a difficult task; they must collect and assimilate data from a variety of sources which differ widely with regard to quality, currency and coverage. This is because of legislative restrictions on access to public sector data sources and organizational constraints on access to property data within the private sector, such as confidentiality and commercial secrecy. Proposes a system for the dissemination of property data for valuation and other property-related procedures, namely, a National Land Information Service (NLIS). Suggests that a NLIS should be developed using geographical information system technology. Describes a methodology which shows how a spatial analysis technique available on a GIS was used to examine the influence of accessibility on property value.

Gatheru and Nyika (2015) investigate the application of Geographic Information System (GIS) in property valuation. The study adopted descriptive research design to investigate the relationship between value of land and the factors influencing it. A population of 400 land parcels was used with a sample size of 100 parcels of land. Data collection was done by use of questionnaires. A multivariate regression model was used to link the independent variables to the dependent variable. The resultant Hedonic Pricing Model (HPM) indicated that the value of land can be predicted by using the following key attributes; land size, accessibility to bypass, accessibility to primary school. Results also showed that Hedonic Pricing Model is objective and verifiable and hence an ideal method of valuation.GIS technique has proved to be a powerful tool in ensuring that a geodatabase of all the attributes of each parcel of land is stored and retrievable at the clique of a button. The valuation map that was produced enables

quick decision making, as all the values of each parcel are displayed graphically. It is recommended that the HRM and GIS be used to do property valuation.

Ayedun,. Akinjare, Omodo and Alimi (2023) examined Geographical Information System (GIS) Application to Property Valuation Practices in Port Harcourt Metropolis of Rivers State, Nigeria. The study revealed that technology has in the recent years been vehicle for improving effectiveness and precision by different professions in an attempt to achieving the best practice by these professions. One of such technologies which can employ to aid Estate Surveying and Valuation practice is Geographical Information System (GIS). Valuation of properties including real estate and other assets have often been carried out through the application of manual methods which is often found to be cumbersome and sometimes not producing accurate and reliable results. It is in realization of the inherent deficiency entailed in the application of manual approach in carrying out valuation that this study seeks to investigate the application of Geographic Information System (GIS) to the art of valuation practice in Nigeria using Port Harcourt Metropolis of Rivers State as a case study with a view to ascertaining its inherent benefits to valuation practice. To achieve the aim of the study, questionnaires were administered to seventy-four (74) estate surveying and valuation firms randomly selected in the study area. Presentation and analysis of data was done using mean and relative important index. Finding from the study revealed that estate surveyors and valuer are quite aware of the inherent benefits of the geographical information system (GIS) to property valuation, but only very few of the Estate Surveying and Valuation firms make use of it in their valuation practice. The study further revealed that majority of the Estate Surveying and Valuation firms were willing to adopt its use if only they could gain better understanding of its application to valuation practice as its application is bound to having positive effect on the practice of Estate Surveying and Valuation profession. Based on the

findings, the study recommends that training should be held to equip estate surveyors and valuers with the required skills for the application of geographical information system (GIS) since empirical research has shown that it has potential of enhancing valuation practices.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Preamble

The study of the concepts, processes, and methods used to gather data and knowledge for the purpose of conducting independent research in order to arrive at a set of results that efficiently and satisfactorily address the research questions and contribute to the achievement of the research goals is referred to as research methodology. According to Allan and Randy (2005), research methodology covers the process used in gathering and analysing data as well as the logic behind the methods so that the results can be evaluated not only by the researcher; but also by other parties.

3.2 Research Design

Survey research design was adopted for this study. According to Omoroguiwa (2006), survey research design is one in which a group of people or term is studied by collecting data from only a few people or item considered to be representative of the entire group. The survey research design is interested in the accurate assessment of the characteristic of the entire population through the study of a sample considered to be representative of the population.

3.3 Sources of Data

The research basically applied the use of the two main sources of data in obtaining necessary information for the research; which include primary and secondary sources of data.

3.3.1 Primary Sources of Data

Primary data is the data obtained from direct contact with the respondents serving as the sample for a particular research like questionnaire and oral interview. The primary data required for this research will be sourced through a questionnaire.

Questionnaire

The questionnaire instrument is a method of extracting data from respondents in basic questioning. It is designed in order to get responses that help in achieving the aim and objective of the research work. The questionnaire for this research contains questions and statements directed primarily towards obtaining information in respect of the study at hand which is to be administered to Estate surveyors as owner occupiers and the professionals in the built environment (Estate Developers, Property Consultants/Advisory) within the study area.

A questionnaire survey will be adopted because it can be used to gather information from large samples. A well-structured questionnaire containing closed ended questions with suggested answers measured on a 4- Likert Scale is to be used. The questionnaire is specifically designed towards examining the impact of Geographic Information Systems (GIS) on property valuation accuracy.

By observation

The observation method of primary data collection includes the use of sense organs in recognising and recording data by surveillance without interviewing the subjects of study considering the present facts and not the past or future events. Though not suitable where large samples are present because it can wear the observer down and increase fatigue, it was also employed in this study because dilapidated buildings can easily be spotted.

Interview

An interview is a structured conversation where one participant asks questions, and the other provides answers. It is commonly used in various contexts, such as job recruitment, research, journalism, and academic studies. In a research context, an interview may gather qualitative data from participants about their experiences or opinions.

The effectiveness of an interview often depends on the preparation of both the interviewer and the interviewee, as well as the environment in which it takes place.

3.3.2 Secondary source of data

In obtaining the secondary data of this research, the review on literature aspect of this dissertation was on the basis of intensive reading and studying of published textbooks, lecture notes, journal, magazines, workshop papers, articles in academic and professional journals on the subject matter with the aim of acquiring an in-depth knowledge of the subject of discussion. The analysis of the data that was obtained was interpreted by the use of methods adopted by different researchers in similar research topics.

3.4 Study population

This refers to the totality of all elements, subjects, or members that possess one common or a set of common characteristics.it can also be defined as the entire group of objects, elements, or observations that is the target or subject of investigation. The target population for this research therefore are Estate Surveyors and Valuers in Benin City.

3.5 Sample frame

Sampling frame refers to the list of sampling units in the survey population and also include the non-theoretical population and size from which sample are drawn i.e. the accessible population which may not include the entirety of population (Trochim, 2006). A sample frame is a population the researcher can use in determining the sample size and is a result of the target population. The sample frame for this research is a 66 Estate surveying and valuation firms in Benin City. This figure was obtained from the Nigerian Institution of Estate Surveyors and Valuers, Edo State branch unpublished register.

3.6 Sample size

This refers to all members of the population that have been selected as samples of the population to study, it is a sample frame ratio. According to Creswell and Creswell (2017), the sample size should be sufficient to generate insights on the research questions while also being feasible in practice.

For this research work the sample size will consist of 66 estate surveyors and valuers in Benin city which is the total enumeration of the sample frame.

3.7 Sampling Techniques

Sampling techniques relates to the methods used in the selection of samples from the population given. The study will adopt random sampling techniques where each member of the population has equal opportunity or likelihood of being included in the sample; in order to prevent being biased and to obtain a good representation of the population. The simple random sampling method will be used in selecting one estate surveyor and valuer, in each of the firms for the purpose of this study.

3.8 Methods of Data Analysis

Data generated for this research work will be analysed using descriptive statistical method. This statistical method includes; tables, frequencies, mean and standard deviation.

Table 3.1: Summary of Analytical Tool to be adopted

S/N	OBJECTIVES	ANALYTICAL METHOD
1	Capabilities and functionalities of GIS	Mean and Standard Deviation
2	Benefits of GIS application	Mean and Standard Deviation
3	Challenges associated with the implementation of GIS in property valuation	Mean and Standard Deviation

The Mean is suitable because it can be used to represent typical values and also serve as a yardstick for all observations, while the standard deviation tells about the shape of the distribution, how close the sample mean is from the overall population.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

4.1 Preamble

This chapter discusses data presentation and interpretation. The study had three research questions. The researcher would be able to draw conclusions on the impact of geographic information system (GIS) on property valuation. The study questions were answered by thoroughly analysing the data. The item responses were counted and percentages determined. 66 copies of the questionnaires were administered, however only 57 copies were retrieved, and used to sample respondents' opinions. Respondents were drawn from surveyors and valuers in Benin City.

4.2 Administration of Questionnaire

Table 4.1: Administration of Questionnaires

CLASSIFICATION	FREQUENCY	PERCENTAGE
Retrieved	56	86%
Un-retrieved	10	14%
Total	66	100%

Source: Researcher's fieldwork 2025

4.3 Personal Data of the Respondents

Table 4.2: Personal Data of Respondents

DEMOGRAPHICS	FREQUENCY	PERCENTAGE
GENDER		
Male	47	84%
Female	9	16%
Total	**56**	**100%**

EDUCATIONAL QUALIFICATION		
B.Sc. & HND	42	74%
M.Sc.	14	26%
Total	**56**	**100%**
PROFESSIONAL QUALIFICATION		
Fellow	8	14%
Associate Member	48	86%
TOTAL	**56**	**100%**

Source: Researcher's fieldwork 2025

Table 4.2 above presents the personal data of the respondents. For the gender of the respondents, it was discovered that 84% of the respondents are male, while 16% of the respondents are female. This goes to show that majority of the respondents are male.

For the educational qualification of the respondents, it was observed that 74% of the respondents are B.Sc. and HND holders, while M.Sc. holders were 26% of the total respondents. This suggests a strong academic foundation among professionals in the field, which is essential for competence in property valuation and GIS application.

The result for the professional qualification of the respondents shows that 14% of the respondents are fellows, while 86% of the respondents are associate members. Therefore, majority of the respondents are associate members. The fact that 86% of respondents are associate members indicates that a majority of the participants have attained a recognized level of professional competency. This suggests that their opinions on the adoption and effectiveness of GIS (Geographical Information Systems) in property valuation are well-informed and reliable.

4.4 Analysis of Research Questions

Research Question 1: What are the capabilities and functionalities of GIS that can be applied to property valuation?

Table 4.3: The capabilities and functionalities of GIS to property valuation

	ITEM	SA	A	D	SD	Mean ($\bar{x}$)	S.Dev
1	GIS can effectively integrate various data sources, such as demographic and economic information, to support property valuation	43 (77%)	13 (23%)	-	-	**3.29**	**1.15**
2	GIS technology enhances the accuracy of property valuation by providing detailed spatial analysis	29 (53%)	27 (47%)	-	-	**3.26**	**1.12**
3	GIS applications facilitate the identification of comparable properties, improving market analysis for valuations	31 (55%)	25 (45%)	-	-	**3.27**	**1.16**
4	Spatial modeling tools within GIS allow for better predictions of property value trends over time	50 (89%)	6 (11%)	-	-	**3.33**	**1.17**
5	The ability to visualize property data on maps significantly improves decision-making in property valuation	52 (93%)	4 (7%)	-	-	**3.36**	**1.21**

Source: Researcher's Field survey, 2025

Table 4.3 shows respondents' view on the capabilities and functionalities of GIS to property valuation, with mean values ranging from 3.26 to 3.36. Item 1 shows that GIS can effectively integrate various data sources, such as demographic and economic information, to support property valuation, having a mean of 3.29.

Item 2 shows that GIS technology enhances the accuracy of property valuation by providing detailed spatial analysis, with a mean of 3.26. Item 3 shows that GIS applications facilitate the identification of comparable properties, improving market analysis for valuations, having a mean of 3.27.

Item 4 shows that Spatial modeling tools within GIS allow for better predictions of property value trends over time, with a mean of 3.33. Item 5 shows that the ability to visualize property data on maps significantly improves decision-making in property valuation, having a mean of 3.36.

Therefore, it can be inferred GIS has capabilities and functionalities that can be applied to property valuation by facilitating the identification of comparable properties, improving market analysis for valuations and it enhances the accuracy of property valuation by providing detailed spatial analysis and the ability to visualize property data on maps significantly improves decision-making in property valuation.

Research Question 2: What are the factors that influence the effectiveness of GIS on valuation accuracy?

Table 4.4: Factors that influence the effectiveness of GIS on property valuation.

S/N	ITEM	SA	A	D	SD	Mean ($\bar{x}$)	S.Dev
6	User proficiency and training in GIS software play a critical role in achieving accurate valuation results	36 (65%)	20 (36%)	-	-	**3.21**	**1.10**
7	The integration of real-time data into GIS enhances the precision of property valuations	52 (93%)	4 (7%)	-	-	**3.36**	**1.26**
8	Access to comprehensive and updated geographic information systems data is essential for accurate valuation	50 (89%)	6 (11%)	-	-	**3.31**	**1.21**
9	The quality and accuracy of the underlying data significantly influence the effectiveness of GIS in property valuation	43 (77%)	13 (23%)	-	-	**3.29**	**1.18**
10	The capability of GIS to model complex spatial relationships impacts the accuracy of property valuation outcomes	31 (55%)	25 (45%)	-	-	**3.19**	**1.06**

Source: Researcher's Field survey, 2025

Table 4.4 shows respondents' view on factors that influence the effectiveness of GIS on valuation, with mean values ranging from 3.19 to 3.36. Item 6 shows that user proficiency and training in GIS software play a critical role in achieving accurate valuation results, having a mean of 3.21.

Item 7 shows that the integration of real-time data into GIS enhances the precision of property valuations, having a mean of 3.36. Item 8 shows that access to comprehensive and updated geographic information systems data is essential for accurate valuation, with a mean of 3.31.

Item shows that the quality and accuracy of the underlying data significantly influence the effectiveness of GIS in property valuation, with a mean of 3.29. Item 12 shows that the capability of GIS to model complex spatial relationships impacts the accuracy of property valuation outcomes, with a mean of 3.19.

Therefore, this however goes to show that there are factors that influence the effectiveness of GIS on valuation accuracy include user proficiency and training in GIS software, integration of real-time data into GIS, access to comprehensive and updated geographic information systems data, and the quality and accuracy of the underlying data.

Research Question 3: What are the benefits of GIS application in property valuation?

Table 4.5: Benefits of GIS application in property valuation

S/N	ITEM	SA	A	D	SD	Mean ($\bar{x}$)	S.Dev
11	GIS applications provide a comprehensive view of property characteristics, enhancing valuation accuracy	31 (55%)	25 (45%)	-	-	**3.27**	**1.16**
12	The integration of GIS with other data sources improves the overall quality of property valuation reports	20 (36%)	21 (38%)	15 (27%)	-	**2.83**	**.801**
13	GIS facilitates better decision-making by visualizing spatial relationships and trends in property values	36 (65%)	20 (36%)	-	-	**3.21**	**1.10**
14	GIS helps identify market trends and patterns that can inform future property investments	52 (93%)	4 (7%)	-	-	**3.36**	**1.26**
15	The use of GIS in property valuation increases the efficiency of the valuation process	52 (93%)	4 (7%)	-	-	**3.31**	**1.18**

Source: Researcher's Field survey, 2025

Table 4.5 shows respondents' view on benefits of GIS application in property valuation, with mean values ranging from 3.26 to 3.36. Item 1 shows that GIS can effectively integrate various data sources, such as demographic and economic information, to support property valuation, having a mean of 3.29.

Item 11 shows that GIS applications provide a comprehensive view of property characteristics, enhancing valuation accuracy, with a mean of 3.27. Item 12 shows that the integration of GIS with other data sources improves the overall quality of property valuation reports, having a mean of 3.83.

Item 13 shows that GIS facilitates better decision-making by visualizing spatial relationships and trends in property values, with a mean of 3.33. Item 14 shows that GIS helps identify market trends and patterns that can inform future property investments, having a mean of 3.36.

Item 15 shows that the use of GIS in property valuation increases the efficiency of the valuation process, having a mean of 3.31.

Therefore, it can be inferred that GIS application has significant impact in property valuation. Hence, its applications provide a comprehensive view of property characteristics, enhancing valuation accuracy, facilitates better decision-making by visualizing spatial relationships and trends in property values and helps identify market trends and patterns that can inform future property investments.

Research Question 4: What are the challenges associated with implementing smart technology in property management?

Table 4.6: Challenges and limitations in implementing GIS for property Valuation

S/N	ITEM	SA	A	D	SD	Mean ($\bar{x}$)	S.Dev
16	Lack of trained personnel proficient in GIS technology poses challenges to effective implementation.	56 (100%)	-	-	-	**3.41**	**1.29**
17	Integration of GIS with existing property valuation processes is often complex and time-consuming	56 (100%)	-	-	-	**3.41**	**1.29**
18	High costs associated with GIS software and data acquisition limit its implementation for property valuation	43 (77%)	13 (23%)	-	-	**3.29**	**1.15**
19	Data quality and accuracy issues hinder the reliability of GIS for property valuation purposes	50 (89%)	6 (11%)	-	-	**3.27**	**1.18**
20	Resistance to change among stakeholders can impede the adoption of GIS technologies in property valuation	30 (54%)	22 (39%)	4 (7%)	-	**3.01**	**.921**

Source: Researcher's Field survey, 2025

Table 4.6 shows respondents' view on challenges and limitations in implementing GIS for property Valuation, with mean values ranging from 3.01 to 3.41. Item 16 shows that lack of trained personnel proficient in GIS technology poses challenges to effective implementation, having a mean of 3.21.

Item 17 shows that integration of GIS with existing property valuation processes is often complex and time-consuming, having a mean of 3.41. Item 18 shows that high costs associated with GIS software and data acquisition limit its implementation for property valuation, with a mean of 3.29.

Item 19 shows that data quality and accuracy issues hinder the reliability of GIS for property valuation purposes, with a mean of 3.27. Item 20 shows that resistance to change among stakeholders can impede the adoption of GIS technologies in property valuation, with a mean of 3.01.

Therefore, this however goes to show that factors that there are several challenges and limitations in implementing GIS for property Valuation amongst which include lack of trained personnel proficient in GIS technology, high costs associated with GIS software and data acquisition, data quality and accuracy issues and resistance to change among stakeholders.

4.4 Discussions of Findings

In examining the ability and functionality of GIS in relation to property valuation, it was discovered that GIS has capabilities and functionalities that can be applied to property valuation by facilitating the identification of comparable properties, improving market analysis for valuations and it enhances the accuracy of property valuation by providing detailed spatial analysis and the ability to visualize property data on maps significantly

improves decision-making in property valuation. This is however in line with Doko and Denes (2019) who asserted that Geographic Information Systems (GIS) play a crucial role in property valuation by providing spatial data and analytical tools that enhance decision-making and accuracy. GIS enables the integration of various data layers, such as land use, zoning, topography, infrastructure, and environmental factors, to assess property characteristics. By visualizing property data on maps, GIS allows appraisers, real estate professionals, and investors to analyze trends, compare properties, and identify factors influencing market value. Additionally, GIS can model scenarios, assess accessibility to amenities, and predict the potential impact of changes in the neighborhood, helping to improve property value assessments and streamline the valuation process.

In ascertaining the factors that influence the effectiveness of GIS on valuation accuracy, it was found that factors that influence the effectiveness of GIS on valuation accuracy include user proficiency and training in GIS software, integration of real-time data into GIS, access to comprehensive and updated geographic information systems data, and the quality and accuracy of the underlying data. This is in line with and Almutairi and Mutanga (2020) who asserted that the effectiveness of GIS in property valuation is influenced by several key factors, including the quality and accuracy of the data used, the sophistication of the GIS tools and analysis methods, and the expertise of the users interpreting the information. High-quality, up-to-date spatial data, such as accurate property boundaries, land use zoning, and environmental conditions, is critical for precise valuation. Additionally, advanced GIS techniques, such as spatial analysis and modeling, can enhance valuation accuracy by identifying hidden patterns and correlations in the data. The experience and knowledge of professionals using GIS also play a significant role in ensuring proper interpretation of the results and making informed decisions. Furthermore, external factors like data availability,

the scale of analysis, and local market dynamics can also impact the overall effectiveness of GIS in property valuation.

In exploring the benefits of GIS application in property valuation, it was observed that GIS application has significant impact in property valuation. Hence, its applications provide a comprehensive view of property characteristics, enhancing valuation accuracy, facilitates better decision-making by visualizing spatial relationships and trends in property values and helps identify market trends and patterns that can inform future property investments. This is in line with Jones and Smith (2018) who asserted that the application of GIS in property valuation offers several key benefits, including enhanced accuracy, efficiency, and insight. By integrating spatial data with property-specific information, GIS allows for more precise assessments of market trends, land use patterns, and environmental factors that affect property value. It improves decision-making by enabling professionals to visualize data on interactive maps, identify patterns, and perform spatial analysis to assess location-specific factors like proximity to amenities, infrastructure, or hazards. GIS also streamlines the valuation process, reducing the time and effort required for data gathering and analysis.

Finally, in exploring the challenges and limitations in implementing GIS for property Valuation, it was observed that there are several challenges and limitations in implementing GIS for property Valuation amongst which include lack of trained personnel proficient in GIS technology, high costs associated with GIS software and data acquisition, data quality and accuracy issues and resistance to change among stakeholders. This is in line with Raza and Ali (2020) who asserted that implementing GIS for property valuation comes with several challenges and limitations, including the high costs of acquiring and maintaining accurate, up-to-date spatial data, as well as the complexity of integrating diverse data sources. Many regions face data gaps or inconsistencies, which can undermine the reliability of valuations.

Additionally, GIS requires specialized software and skilled personnel to effectively analyze and interpret the data, creating barriers for organizations without sufficient technical expertise or resources. The need for continual data updates, especially in rapidly changing urban areas, can further complicate the process. Furthermore, GIS-based valuations may not always capture subjective factors, such as neighbourhood appeal or future market trends, which could lead to incomplete assessments.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Preamble

The summary of findings for the study is presented in this section, conclusion reached with recommendation made as regarding a comparative analysis on the impact of geographic information system (GIS) on property valuation accuracy.

5.2 Summary

This study carried out a comparative analysis on the impact of geographic information system (GIS) on property valuation accuracy. Four (4) objectives were raised for the study which are: to Analyze the ability and functionality of GIS in relation to property valuation; to identify the factors influencing GIS effectiveness on valuation accuracy; to ascertain the benefits of GIS application in property valuation; to identify the challenges and limitations associated with the implementation of GIS in property valuation. The study adopted survey research design. The instrument for data collection was a questionnaire; it was built around the research question by the researcher and validated by the researcher's supervisor. 66 copies of the questionnaire was distributed, however, only 56 copies of the questionnaire was retrieved and analysed using descriptive statistics by means of frequency count, simple percentage, Mean and Standard Deviation. The following are findings from the study:

i. GIS has capabilities and functionalities that can be applied to property valuation by facilitating the identification of comparable properties, improving market analysis for valuations and it enhances the accuracy of property valuation by providing detailed spatial analysis and the ability to visualize property data on maps significantly improves decision-making in property valuation.

ii. Factors that influence the effectiveness of GIS on valuation accuracy include user proficiency and training in GIS software, integration of real-time data into GIS, access to comprehensive and updated geographic information systems data, and the quality and accuracy of the underlying data.

iii. GIS application has significant impact in property valuation. Hence, its applications provide a comprehensive view of property characteristics, enhancing valuation accuracy, facilitates better decision-making by visualizing spatial relationships and trends in property values and helps identify market trends and patterns that can inform future property investments.

iv. There are several challenges and limitations in implementing GIS for property Valuation amongst which include lack of trained personnel proficient in GIS technology, high costs associated with GIS software and data acquisition, data quality and accuracy issues and resistance to change among stakeholders.

5.3 Conclusion

Based on the findings, The study concludes that the impact of Geographic Information Systems (GIS) on property valuation accuracy is transformative, offering substantial improvements in the precision and efficiency of property assessments. By integrating diverse spatial data layers, GIS provides a comprehensive view of properties, considering factors such as land use, infrastructure, environmental conditions, and market trends. This allows real estate professionals, appraisers, and investors to make more informed decisions, reducing the risks associated with inaccurate valuations. Furthermore, GIS facilitates the analysis of large datasets, enabling the identification of patterns and correlations that would be difficult to discern manually. With the ability to visualize data and model scenarios, GIS enhances the

overall valuation process, ensuring better resource allocation and improved investment strategies. However, the successful implementation of GIS in property valuation is not without challenges. The accuracy of GIS-based valuations is heavily dependent on the availability, quality, and consistency of spatial data, which can vary significantly across regions. Moreover, the need for specialized software, expertise, and continuous data updates can pose barriers to organizations with limited resources. Despite these obstacles, the potential benefits of GIS in property valuation far outweigh the challenges, especially as technology continues to evolve. As data quality improves and more professionals become adept at using GIS tools, its role in property valuation will only continue to grow, driving more accurate, transparent, and efficient property assessments.

5.4 Recommendations

Based on the analysis and interpretation of the data obtained during this study, the following recommendations are made:

Invest in Data Quality and Regular Updates: To maximize the accuracy of GIS-based property valuations, it is essential to invest in high-quality, up-to-date spatial data. Local governments, real estate organizations, and valuation professionals should prioritize the collection and regular updating of accurate property data, including land boundaries, zoning, infrastructure, and environmental conditions. Collaborations between public and private sectors can help overcome data gaps, ensuring more reliable and consistent datasets for valuation purposes.

Enhance GIS Training and Expertise: Real estate professionals and appraisers must receive adequate training in GIS tools and techniques to fully harness the potential of this technology. Building in-house expertise and investing in ongoing education will ensure that

professionals can interpret complex data and apply GIS insights effectively. Specialized training programs, workshops, and certifications in GIS for property valuation should be promoted by the government or the Nigerian Institution of Estate Surveyors and Valuers (NIESV) to enhance decision-making and valuation accuracy across the industry.

Develop Standardized Methodologies for GIS Integration: To ensure consistency and accuracy in property valuations, it is crucial to develop standardized methodologies for integrating GIS into the valuation process. This includes creating guidelines for data analysis, model building, and interpretation, as well as defining best practices for combining GIS with traditional valuation methods. This can be implemented by the Nigerian Institution of Estate Surveyors and Valuers (NIESV) in collaboration with Estate Surveyors and Valuers Registration Board of Nigeria (ESVARBON). Establishing industry-wide standards will promote greater transparency, reduce discrepancies between different valuation approaches, and enhance the overall credibility of GIS-based property assessments.

5.5 Suggestions for Further Studies

While this study has provided valuable insights into the impact of Geographic Information Systems (GIS) on property valuation in Benin City, there are areas that future researchers can explore to deepen the understanding of GIS applications in real estate.

1. **Expansion to Other Cities and Regions:** This study focused on Benin City. Future research could extend the scope to other Nigerian cities or regions with different property market dynamics to compare findings and assess the broader applicability of GIS in property valuation.
2. **Comparative Studies on GIS-Based and Traditional Valuation Methods:** A comparative study analyzing the accuracy, efficiency, and reliability of GIS-based

valuation versus traditional valuation methods across different property types could provide deeper insights into the advantages and limitations of GIS adoption.

3. **Integration of Artificial Intelligence and Machine Learning with GIS:** Since technology continues to evolve, future studies could explore how artificial intelligence (AI) and machine learning models can enhance GIS applications in property valuation, improving predictive accuracy and automation in valuation processes.
4. **Challenges of GIS Implementation in Developing Markets:** While this study identified some barriers to GIS adoption, further research could focus specifically on financial, technical, and regulatory challenges hindering widespread GIS integration in property valuation within developing economies like Nigeria.
5. **Impact of GIS on Real Estate Investment Decision-Making**: Another area of interest could be an in-depth analysis of how GIS-based property valuation influences real estate investment decisions, particularly in commercial and industrial property markets.

By exploring these areas, future researchers can contribute to the continuous advancement of GIS applications in property valuation, helping real estate professionals, policymakers, and investors make more informed decisions.

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UNIVERSITY OF BENIN

FACULTY OF ENVIRONMENTAL SCIENCE

DEPARTMENT OF ESTATE MANAGEMENT

QUESTIONNAIRE ON
IMPACT OF GEOGRAPHIC INFORMATION SYSTEM (GIS) ON PROPERTY VALUATION ACCURACY

Dear respondents,

My name is Iredia Aigbekaen I am a 500 level student of Estate Management, University of Benin currently carrying out my project research. This questionnaire is designed to assess the impact of geographic information system (GIS) on property valuation accuracy. This research work is purely for academic purpose and will be treated as confidential. You are therefore required to kindly and truthfully respond by providing answers to the questions below.

Section A: Demography (Please specify by filling and ticking the correct information**)**

Name of Firm:

Instructions: Please tick (√) where applicable.

Gender: Male ( ) Female ( )

Educational Qualification: B.sc. ( ) M.sc.( )

Professional Qualification: Fellow ( ) Associate above 10yrs ( ) Associate below 10yrs ( )

KEY: SA = Strongly Agree, A = Agree, SD = Strongly Disagree, D = Disagree

S/N	ITEM	SA	A	D	SD
The capabilities and functionalities of GIS to property valuation					
1	GIS can effectively integrate various data sources, such as demographic and economic information, to support property valuation				
2	GIS technology enhances the accuracy of property valuation by providing detailed spatial analysis				
3	GIS applications facilitate the identification of comparable properties, improving market analysis for valuations				
4	Spatial modeling tools within GIS allow for better predictions of property value trends over time				
5	The ability to visualize property data on maps significantly improves decision-making in property valuation				
Factors that influence the effectiveness of GIS on valuation accuracy					
6	User proficiency and training in GIS software play a critical role in achieving accurate valuation results				
7	The integration of real-time data into GIS enhances the precision of property valuations				
8	Access to comprehensive and updated geographic information systems data is essential for accurate valuation				
9	The quality and accuracy of the underlying data significantly influence the effectiveness of GIS in property valuation				
10	The capability of GIS to model complex spatial relationships impacts the accuracy of property valuation outcomes				
Benefits of GIS application in property valuation					

11	GIS applications provide a comprehensive view of property characteristics, enhancing valuation accuracy				
12	The integration of GIS with other data sources improves the overall quality of property valuation reports				
13	GIS facilitates better decision-making by visualizing spatial relationships and trends in property values				
14	GIS helps identify market trends and patterns that can inform future property investments				
15	The use of GIS in property valuation increases the efficiency of the valuation process				
Challenges and limitations in implementing GIS for property Valuation					
16	Lack of trained personnel proficient in GIS technology poses challenges to effective implementation.				
17	Integration of GIS with existing property valuation processes is often complex and time-consuming				
18	High costs associated with GIS software and data acquisition limit its implementation for property valuation				
19	Data quality and accuracy issues hinder the reliability of GIS for property valuation purposes				
20	Resistance to change among stakeholders can impede the adoption of GIS technologies in property valuation				

Thank you