



**6th UNDERGRADUATE  
SEMINAR ON BUILT  
ENVIRONMENT  
AND TECHNOLOGY  
(USBET) 2023**

**SUSTAINABLE BUILT  
ENVIRONMENT**

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# e-Proceeding

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## A SYSTEMATIC REVIEW ON THE USE OF GIS IN REAL ESTATE VALUATION

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### ABSTRACT

*Property valuation is carried out manually, mostly documented in files. The manual process follows the sequence from obtaining the instruction from the client to property inspection and valuation. This manual procedure is energy exhausting, time consuming and costly for large areas with different types of properties. The culmination of new technologies improves data precision and effectiveness to which the Geographical Information System (GIS) comes into the picture of real estate valuation. Yet, less emphasis has been given on the use of GIS in real estate valuation. Hence, this study was set out to analyse the existing literature on the possible use of GIS in real estate valuation. The PRISMA review method had resulted in four main themes, they were data visualisation, price prediction model, mass valuation and cloud storage. For further research, these four themes could contribute in the development of a comprehensive integration between GIS and real estate valuation practice.*

**Keywords:** *geographic information system, real estate, property valuation*

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## **INTRODUCTION**

To measure the properties and gather other pertinent information for the purpose of determining the subject property's estimated worth, a manual technique of valuation that requires physical visitation and inspections of the sites is used. However, this procedure could be difficult in particularly big locations. Property valuation using manual processes could be energy exhausting, time consuming and costly for large areas and many other properties (Eboy, 2014). This is to note that the real estate valuation industry needs reliable data as well as reliable analytical data tools for efficient results. GIS functions as an automated system for managing databases, storing, retrieving, analysing and presenting location-based data using spatial coordinates (Ayedun et al., 2022). Prominent firms such as Sime Darby Plantations had also been utilising GIS to help monitor the management of palm oil trees using remote sensing, which is an integrated GIS tool to help stakeholders, particularly also the professional valuers, to make informed decisions regarding the sustainable sourcing practices (Sim Choon Cheak, 2023). Hence, this is where GIS takes place as it provides a better outcome compared to the results of conventional statistical tools.

## **SYSTEMATIC REVIEW METHODOLOGY**

The reviewers used the method called Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA). The systematic review procedure involved four phases namely identification, screening, eligibility, and inclusion phases that was performed in January 2023. The first phase identified keywords used for the search process and the use of thesaurus for the keywords that were related to GIS and real estate valuation. The review relied on two main journal databases namely, Web of Science and Scopus for screening phase. In the next phase, authors only literature with empirical data and reviews that are peer reviewed for eligibility criteria. Lastly, the inclusion criteria are publications in Malay and English language and GIS in real estate valuation. The remaining articles were assessed and analysed for review analysis. Efforts were concentrated on the specific studies that responded to the formulated question. The data was extracted by reading the abstracts first, then the full articles in-depth to identify appropriate themes and sub-themes. By using thematic content analysis, the attributes related to use of GIS in real estate valuation were identified.

## **DATA ABSTRACTION ANALYSIS AND DISCUSSION**

This section describes how GIS can be integrated in real estate valuation through various aspects which helps ease the valuation practitioner's work.

## Application of GIS in Real Estate Valuation

The possible use of GIS in Real estate valuation is summarised in Table 1.

**Table 1: Possible Use of GIS in Real Estate Valuation**

Themes	Brief Discussion	Authors
Data Visualisation	Adjustment for terrain and flood risk.	Desalegn & Mulu (2021), Fenglin, W. (2023), Muzaffar, D. (2017)
	Site suitability for urban growth is essential and efficient to move towards a better urban growth location and the approach allocates different weight and criteria.	Santosh C (2018), Bowlin (2015), Beames (2018), ArcGIS Solutions (2023)
	Provide building information for taxable properties calculation and valuation	Osland et al (2022), Liu (2017), Wyatt (1996)
Mass valuation	Estimating the property values of large quantities in a short time with little manpower and low cost.	Eboy, O. (2014), Esri (2021), Local Authorities Act (1976)
Cloud storage	Provides high performance of data storage and computing capabilities	Metete, M. (2021)
Price Prediction Model	Importance of amenities around the properties for price prediction.	Nazemi B (2020), Hyndman and Athanasopoulos (2018), Rui Liu and Lu (2019)

(Authors' Research, 2023)

Four main themes were identified. First is data visualisation where the use of GIS in real estate valuation where it was divided into three parts, data visualization for the adjustment through the terrain's slopes aspects and roughness effect, the site suitability for urban growth and to provide building information for taxable properties valuation. Second is the use of GIS for mass valuation to estimate property values of large quantities in a short time with little manpower and low cost. Third theme is the cloud storage in GIS that provides high performance of data storage and computing capabilities and the fourth theme, the price prediction model in GIS which helps analysing the amenities of the properties around the area for price prediction.

## **DATA VISUALIZATION**

Real estate data can be displayed in maps, charts, and graphs using GIS visualisation, which makes it possible to identify important insights that would not be achievable using conventional data analysis techniques. In this section, we will discuss on how data visualizations help with real estate valuation practice.

### **Adjustment For Terrain and Flood Risk.**

Fenglin et al. (2023) states that geospatial planning is crucial for reducing flood risks and improving disaster management. Geospatial technology provides the best decision-making method by enabling the creation of flood hazard maps and conducting flood risk analysis. Desalegn and Mulu, (2021) used ArcGIS to generate a flood risk map by analysing terrain characteristics such as soil type, slope, rainfall, elevation, drainage density and land use. GIS technology processes these factors and facilitates informed decision-making for flood risk management. Muzaffar, (2016) highlights that GIS technology enhances valuation works by adjusting factors related to slopes and roughness. By analysing terrain factors through GIS, a more accurate assessment of property value can be achieved by considering the impact of terrain characteristics on land usability and limitations. The author examines slope aspects using GIS, which involves assessing slope direction, steepness, and their implications for sunlight exposure, drainage patterns and views. Additionally, the author evaluates the roughness effect by analysing surface irregularities, elevation variations, and their potential impact on accessibility and land development. Muzaffar, (2016) integrates the data using Digital Elevation Model (DEM) and ArcGIS to determine terrain values for slope and surface roughness, aiding in identifying terrain characteristics that influences property value.

### **Site Suitability for Urban Growth**

GIS is a valuable tool for real estate analysis, site selection, and property mapping (Bowlin, 2015). It aids in assessing risk, determining property value, and identifying trends (ArcGIS Solutions, 2023). Accurate data on land use, slope, cost, aspects, road proximity, and lineament are essential for GIS-based site suitability (Santosh et al., 2018). The weighted overlay approach and spatial proximity analysis support site analysis for real estate valuation which it considers the amenities, community, and future inhabitants where it is crucial in the analysis process (Beames, 2018).

### **Providing Building Information**

GIS plays a significant role in property valuation by utilizing the mapping techniques to identify building locations and characteristics (Wyatt, 1996). It integrates the building permit and ownership data, as well as infrastructure and hazard information, where it offers a comprehensive perspective on the building's data and enables the



application in diverse areas such as urban planning, building design, construction management, and maintenance (Liu, 2017).

## **MASS VALUATION**

Next, GIS helps in mass valuation on estimating the properties values in large quantities in short amount of time with little manpower and low cost. It involves evaluating numerous properties using statistical techniques and automated valuation approaches, providing consistency and regularity in ad valorem assessments. Deddis, (2002). With the aid of Geographic Information System, a single census region can be studied in detail for population evolution (Esri, 2021). In Malaysia, manual revaluations have been exhaustive, time-consuming, and costly due to the large areas and properties involved (Esri, 2021). To expedite the valuation process, a property value model can be employed to value every piece of real estate in a broad area (Wei, 2022). Research by Eboy, (2014) states the Ordinary Least Square (OLS) method, integrated with GIS, becomes a component of spatial statistics and aids in spatial regression, assisting local governments in reducing costs and streamlining reassessments.

## **CLOUD STORAGE**

Then, the cloud storage in GIS provides high performance of data storage and computing capabilities which utilizes the databases for geospatial data processing, enabling valuers to analyse properties for valuation purposes. Mete (2021) referred this cloud storage in GIS applications is the new generation of cloud architecture, referred to as serverless computing. Land valuation is complex; hence GIS simplifies the land valuation, considering various influencing factors and efficiently handles big data for mass land assessments (Kulawiak, 2019). GIS-based randomised approaches enable for a quick and effective mass valuation for large areas, proving cost and time effective, as well as helps in storing these large databases all in one system (Wei, 2022 & Bencardino, 2017).

## **PRICE PREDICTION MODEL**

GIS provides an accurate predictive approach for estimating property prices by analysing spatial factors like location, amenities, and neighbourhood surroundings Nazemi, (2020). Machine learning, particularly short-term memory with modified generic algorithms, has proven more efficient in predicting housing prices compared to traditional methods (Rui Liu and Lu Liu, 2019) & Hyndman and Athanasopoulos, (2018). Descriptive maps make price changes more objective and visible over time, aiding in practical urban housing initiatives (Rui Liu and Lu Liu, 2019).

## CONCLUSION

This systematic review has highlighted the use of Geographic Information System (GIS) in real estate valuation; where it aids in analysing spatial factors to estimate the property values to enhance the transparency and critically assess the rigor of review methods in GIS applications. Based on the systematic reviews performed, the authors have identified four main themes related to the use of GIS in real estate valuation namely for its data visualization for terrain adjustments and flood risk assessments, mass valuation in large areas, price prediction model for a certain area and cloud storage for huge databases. Consequently, from the review, it is evident that GIS's capabilities play a crucial role in supporting decision-making and understanding complex spatial relationships. For future study, qualitative study is needed on the use of GIS in real estate valuation where it provides a more nuanced comprehension of the factors that influence the incorporation of GIS in real estate valuation. More explicit and detailed reporting of analysis methods for qualitative reviews can result in an improved transparency and increased ability to assess the rigour of the review method critically.

## REFERENCES

- ArcGIS Solution (2023)> Introduction to Parcel Value. Retrieved from <https://doc.arcgis.com/en/arcgis-solution/latest/reference/introduction-to-parcel-value-analysis.html>
- Ayedun, C. A., Akinjare, O. A., Omodo, E., & Alimi, R. K. (2022). *Geographical Information System (GIS) Application to Property Valuation Practices in Port Harcourt Metropolis of Rivers State, Nigeria*. Journal of International Cooperation and Development, 5(1), 19.
- Beames, A., Broekx, S., Schneidewind, U., Landuyt, D., Van der Meulen, M., Heijungs, R., & Seuntjens, P. (2018). *Amenity proximity analysis for sustainable brownfield redevelopment planning*. *Landscape and Urban Planning*, 171, 68-79.
- Bencardino, M., & Nesticò, A. (2017). *Demographic changes and real estate values. A quantitative model for analysing the urban-rural linkages*. *Sustainability*, 9(4), 536.
- Bowlin, E. (2015). *Utilizing Web-Based GIS Applications for Spatial Analysis of Real Estate Appraisal Data*.

- Deddis, W., McCluskey, W., & Lamont, I. (2002). Development of a geographic information system for mass appraisal of residential property. *RICS Education Trust, 1(1), 4*.
- Desalegn, H., & Mulu, A. (2021). *Flood vulnerability assessment using GIS at Fetam watershed, upper Abbay basin, Ethiopia. Heliyon, 7(1), e05865*.
- Eboy, O. V., & Samat, N. (2014). *Development of Property Valuation Model for Tax Purposes Using Ordinary Least Square Method*. International Journal of Environment, Society and Space, 2(1), 61-71.
- Esri (2021). GIS for real estate. Precise Real Estate Insight. Esri.com. Retrieved from <https://www.esri.com/en-us/industries/real-estate/overview>
- Fenglin, W., Ahmad, I., Zelenakova, M., Fenta, A., Dar, M. A., Teka, A. H. & Shafi, S. N. (2023). Exploratory regression modeling for flood susceptibility mapping in the GIS environment. *Scientific Reports, 13(1), 247*.
- Hyndman, R. J., & Athanasopoulos, G. (2018). Forecasting: principles and practice. *OTexts*.
- Kulawiak, M., Dawidowicz, A., & Pacholczyk, M. E. (2019). *Analysis of server-side and client-side Web-GIS data processing methods on the example of JTS and JSTS using open data from OSM and geoportal*. Computers & Geosciences, 129, 26-37.
- Liu, R. and Liu, L. (2019), "Predicting housing price in China based on long short-term memory incorporating modified genetic algorithm", *Soft Computing*, Vol. 23 No. 22, pp. 11829-11838.
- Liu, X., Wang, X., Wright, G., Cheng, J. C., Li, X., & Liu, R. (2017). *A state-of-the-art review on the integration of Building Information Modeling (BIM) and Geographic Information System (GIS)*. ISPRS International Journal of Geo- Information, 6(2), 53
- Mete, M. O., & Yomralioglu, T. (2021). *Implementation of serverless cloud GIS platform for land valuation*. International Journal of Digital Earth, 14(7), 836- 850.
- Mudzaffar Ali, D. (2016). Quantifying terrain factor using GIS applications for real estate property valuation. *Student thesis series INES*.

- Nazemi, B., & Rafiean, M. (2021). *Forecasting house prices in Iran using GMDH*. *International Journal of Housing Markets and Analysis*, 14(3), 555-568.
- Osland, L., Östh, J., & Nordvik, V. (2021). House price valuation of environmental amenities: An application of GIS-derived data. *Regional Science Policy & Practice*.
- Santosh, C., Krishnaiah, C., & Deshbhandari, P. G. (2018, June). *Site suitability analysis for urban development using GIS based multicriteria evaluation technique: a case study in Chikodi Taluk, Belagavi District, Karnataka, India*. In IOP Conference Series: Earth and Environmental Science (Vol. 169, No. 1, p. 012017). IOP Publishing.
- Sim Choon Cheak. (2023). Geospatial Technologies for Sustainable Palm Oil Production. *Geospatial World*. Retrieved from: <https://www.geospatialworld.net/prime/business-and-industry-trends/geospatial-technologies-sustainable-palm-oil-production/>
- Wei, C., Fu, M., Wang, L., Yang, H., Tang, F., & Xiong, Y. (2022). *The research development of hedonic price model-based real estate appraisal in the era of big data*. *Land*, 11(3), 334.
- Wyatt, P. (1996). *The development of a property information system for valuation using a geographical information system (GIS)*. *Journal of Property Research*, 13(4), 317–336.

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