THEME

Data Transparency and Availability in Global Valuation Practices

A Review Study on Automation for Real Estate Property Valuations Using Advanced Digital Technology

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Abstract

Property valuation plays significant role in nation's economy decisions and financial reliability. Current state of property valuation still comprises of ambiguity, inaccuracy, and inefficiency. The valuation of property consists of both subjective and objective factors. Some factors are fixed throughout the property lifecycle and other are variable with time, thereby making the property value inconsistent throughout its lifecycle. The motivation of this paper is to examine and review information and factors that influence real estate property valuations and how those factors extraction and automation for property valuation can be improved by leveraging advance digital technology. For this research, an approach of review of research was carried to understand the factors that influence property valuations and how they can be apprehend automatically with various reviewed digital technology to efficiently perform property valuations. The research will be summarized demonstrating list of digital technologies in built environment which can enhance real-time property valuation.

Keywords: Digital Technology, Property Valuation, Real Estate Property

1 Introduction

1.1. Overview

Property valuation plays an important role in a nation's financial reliability and economic decisions [4]. Property's value is defined as the current worth of future benefits that arise from the ownership of the property for the rights to receive capital in the future [1, 2]. Property valuation in real estate is a process of determining the

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present market value of assets to ascertain actual price of property [34]. Property valuation is about predicting realistic figure rather than relative figure of the property.

Many possible reasons for property valuation are buy or sell; lease or rent; to assess tax or business rates payable; for insurance; to obtain a compensation payment; to borrow money using the property; to show its value as a fixed asset on a company balance sheet; and to develop or redevelop. Valuation based on its reason require need assessment on a frequent or recurring basis, others only very occasionally [2]. People tend to find various loopholes to either dodge tax or pay the least possible amount by under valuing their property for tax saving. In order to manage vast real estate portfolios, there is a need for regular property valuations, thus it is crucial to optimize the valuation cost, quality, and duration. Therefore, it is very important to update the conventional valuation process to the automatic one.

Property valuation is a critical aspect of real estate transactions and investment decisions. A property valuation is an assessment of your property's value, based on both subjective and objective factors. Some factors are fixed throughout the property lifecycle and other are variable with time, thereby making the property value inconsistent throughout its lifecycle. Various factors which affect the property valuation are geographic location, accessibility, supply and demand, exciting amenities, present conditions, market conditions, retrofitting opportunities, and upgradation possibilities, similar properties, sustainability aspects, future projections, etc [26]. Conventionally, it is labour-intensive and error prone as it relies on manual inspection and data analysis. However, technological advancement has eliminated. tedious and fallacious tasks, thereby making property valuations efficient and accurate.

An automated valuation model (AVM) is a software-based pricing models that combines mathematical or statistical Modelling with databases of existing properties and transactions to calculate property values with less time, money and effort [3]. Various AVMs compare the values of similar properties at the same time.

Hence, they depend on high-quality data to get accurate property values. Thus, it is very important to update data continuously, in order to avoid outdated and incorrect data for valuations. AVM reports are driven by technology, including proprietary algorithms, that comprise of a hedonic model and a repeat sales index, which are both weighted and analysed to generate the price estimate [3]. The most often cited drawback against AVM is determining the value without evaluating the actual condition of the property [3; 5]. The AVM assumes an average condition of the property, which may not be true, thereby leading to inaccurate property valuation. Absolute value of the real estate property is based on the characteristics and

conditions of the assets [36]. Property and its respective facilities condition and performance is a measure of the well-being of a property. It is a key parameter in determining remaining useful life and can be used to predict when a property needs to be repaired, renewed, or replaced [37]. Evaluating the status of actual property condition throughout the life cycle of property, will support accurate property valuation and enriches property value and price.

Current state of property valuation still comprises of ambiguity, inaccuracy, and inefficiency. Various factors have been considered and enhanced well for the property valuation. Yet, considering actual condition of property have not yet considered or integrated well with property valuation model. Some research has been attempted to enhance property valuation but still a proper holistic approach for property valuation using digital technology is still lacking. Digital technology can promote automated extraction and sharing of various information required for property valuation and pricing and save us from human biases and inconsistencies by encouraging transparency and real-time data sharing. The automated valuation approach can bring time and cost savings, resulting in higher profit margin for property firms. In addition, valuers can spend more time on complex valuations and related issues [46]. Therefore, this research studies how digital technologies can enhance property valuations by accurately evaluating different factors affecting property.

1.2.Objectives

This project will explore the integration of various digital technologies to enhance and automate property valuation accuracy and transparency through automated data and information extraction and sharing.

Specifically, this study targets commercial real estate buildings and investigates the below research questions to carry through the above-mentioned aim.

1) What are the existing challenges with current strategies adopted for property valuation?

2) How did the technological adoption mitigate the risk of erroneous property valuation?

3) What are the advanced digital technologies which can automate property valuation assessment?

By investigating these research objectives, the study will have a significant contribution in the following areas. Firstly, the research explores how adoption of digital technologies promotes property valuation to fill in the gaps current strategies are posing on valuation of the property. Secondly, the research will provide insights how to improve transparency and accuracy in information required throughout the property valuation process. Lastly, the research will put focus on integration of digital

technology and factors affecting property valuation to amalgamate advanced technologies with real estate investment.

2 Literature Review on Real Estate Property Valuation

For competent property valuation, an accurate analysis and estimation of the market price of properties or recent property transactions should be known which represent the attributes of properties [29]. Three common valuation model adopted in market for property valuation are Market Comparison Method - comparisons are made between properties that are similar, Income Capitalization Method - by converting an income stream into value), and Cost Method - estimates the price a buyer should pay for an asset based on land, cost, and depreciation [30]. Property valuation contributes significantly to market economic activities, while it has been continuously questioned on its low transparency, inaccuracy, and inefficiency [35]. In order to accommodate and extract these factors automatically for accurate and efficient property valuation, research and practitioner adopted various innovations and trends such as hedonic pricing models, sustainability assessments, and artificial intelligence. Mete et al. 2022 evaluated various criteria such as, environmental, social-economic, physical, and legal towards a 3D real estate valuation model using technological adoption [31]. To facilitate the determination of precise property valuation, it is crucial to assess real-time valuation of the property which depends on the current condition of the property, identification of any potential issues that may impact the property value and future retrofit and upgrade possibility of the property [38].

Valuation models have been adopted for the last 50 years in the industry, while automated valuation model recently emerged as very crucial with the rise of digital infrastructure. Various automated valuation models and software's such as Forbury commercial (Altus Group 2023) ATTOM AVM (ATTOM 2023), Rockport VAL (ROCKPORT 2023) and ARGUS Val (Altus Group 2023) are available in the market claiming fast and accurate valuation/pricing of a property. However, the software still lacks in capturing the real time condition of the property and other factors automatically, which plays a significant role in absolute property valuation and pricing. Currently, various challenges and gaps have been observed in performing accurate property valuation, such as lack of comparable properties for valuation, subjectivity of valuation, uniqueness and perception of market, fluctuating demand, non-availability of information on condition of the property and maintenance cost, data availability and its reliability, and limited appraisal data [39, 40]. However, this innovation is still limited and in infancy stage, with only focusing automating only few factors and not providing any holistic approach on automated property valuation.

Industrial revolution has brought more complexity to existing processes, requiring new procedures to be devised for smart and automated valuation of real estate

property [32]. Adoption digital technologies can promote automated data-driven property valuation and pricing and save us from human biases and inconsistencies by encouraging predictive maintenance [33]. Jaffery et al. 2022, studied capabilities of BIM to be integrated with different stages and processes in property valuation, especially in relation to advanced AVMs based on AI and ML [34]. Despite all new digital technologies and developments, the key tasks of a valuer will remain the same, such as collecting data, analysing it and determining the market value. Also, the legal requirements for value determination provide the framework and limit the use of digitized valuations [44].

Some researchers have studied adoption of few digital technologies such as BIM, AI into AVMs for better property valuation, but still the adoption is limited in practice, and without exploring other technologies apart from afore mentioned one. Digital technology is playing an increasingly important role in modern property valuation practice by providing greater access to data, improving accuracy and speed, and reducing costs, digital tools are transforming the way that valuations are conducted [43]. Therefore, this research explores how adoption of different technologies integration can help with automated and precise property valuations.

3 Research Methodology

For this research, an approach of review of research was carried to understand the factors that influence property valuations and how they can be apprehend automatically with various reviewed digital technology to efficiently perform property valuations. The research study mapped factors influencing property valuation and digital technologies that can bring automation in extracting and sharing the factors into a matrix. To generate matrix, the research study performs two studies – first on factors affecting property valuation and description of digital technology adopted in built environment**.**

3.1. Factors affecting property valuation

Various factors are responsible for precise property valuation. The most important factors affecting the property valuation are [25, 26, 27, 28]:

- **Qualified Valuer** – Property valuation done by experienced valuer and recognized authority.
- **Purpose of Valuation** – In order to proceed with proper valuation, clear scope should be defined for valuation purpose.
- **Selected Valuation Methods** – Based on the scope of property valuation, appropriate valuation method should be adopted.

- **Geographic Location** – Property location is very important consideration when determining valuation. For example, city centre will have higher pricing that the countryside.
- **Type of property –** the use and purpose of property
- **Neighbourhood of property** – The locality around the property plays major role in property valuation.
- **Connectivity of property** – The utilities and connectivity of the property. If the property is well connected than the valuation will be high.
- **Condition of property –** The integrity of property is another important factor for property valuation. The property with high defects will have less valuation.
- **Master plan and bye laws** – the shape, size and orientation of the property following the laws is also important for property valuation.
- **Age and future prospect of property** – the age of property is another which affects factor property valuation. In addition, the future prospect of property is also crucial for property valuation. The property which can be extended and renovated easily then its value will be high.
- **Market demand and prices** – Factor prevailing to economic condition, interest rates and local real estate trend is another factor which are considered during property valuation.
- **Environment and Legal Restriction** – Since the current trend focuses on sustainability, environmental related restriction is also essential consideration in addition to legal restriction for a property.

3.2. Description of Digital Technology Adopted in Built Environment

The rapid advancements in digital technologies is revolutionizing conventional practices within real estate property valuation. This section highlights key digital technologies that can enhance accuracy for transparency of property valuation process. Some of these technologies as per articles reviewed are as follows:

Building Information Modelling (BIM)

BIM is a digital representation of a property and its related lifecycle information, which significantly improved information flow among stakeholders and property managers involved at various stages-from cradle to grave [6]. BIM has ability to store, share, and exchange physical and functional and information related to property in 3D dimension model [7]. The benefits of BIM adoption are efficient data extraction and exchange, streamlined processes, automated workflow [8]. BIM serves as a data repository for contextual information including building geometry, IoT devices' description, static information and other soft building information collected from occupancy patterns and schedule data like social media, building feedback, occupant interactions, room allocation, weather forecast and financial pricing [13]. BIM models can be used throughout the whole life cycle and maintained over time, the

connection between digital data systems and physical systems offers owners and operators a powerful means of rapidly saving information from a virtual facility model [18]. However, when the data repository in BIM increases, more sophisticated analytical tools are required [18].

Geographic Information System (GIS)

GIS consists of integrated computer hardware and software that store, manage, analyse, edit, output, and visualize geographic data [22, 23]. This can be used as tool in both visualization and decision-making process based on geospatial data. Geospatial data can be analysed to determine [24] (1) the location of features and relationships to other features, (2) where the most and/or least of some feature exists, (3) the density of features in a given space, (4) what is happening inside an area of interest (AOI), (5) what is happening nearby some feature or phenomenon, and (6) and how a specific area has changed over time.

Internet of Things (IoT)

IoT devices like sensors and actuators, can help create beneficial platforms for assisting property management practices such as real-time data access, checking maintainability, creating and updating digital assets and space management [9]. IoT links physical objects of property with digital objects by linking Building Management System (BMS) using BIM models [10, 11]

Cloud computing

IoT devices provide information by sharing through the internet. Cloud computing involves hosting computing services over the Internet and enables connecting different IoT devices to existing Internet infrastructure [14], thereby enabling sharing of information to the stakeholders for further processing. Cloud computing has been widely adopted in the AEC industry as it supports various applications and information storage [15].

Augmented Reality (AR)

Augmented reality is an interactive experience that enhances the real world with computer-generated perceptual information. Using software, apps, and hardware such as AR glasses, augmented reality overlays digital content onto real-life environments and objects to create a 3D experience that allows users to interact with both the physical and digital worlds [20]. AR has helped built environment in real time data visualization [12].

Artificial Intelligence

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems [19]. AI can play a significant role in optimizing built environment operations, making them more efficient and effective. One of the primary benefits of AI is the ability to automate many routine tasks [16]. Predictive analytics is a significant application of AI in this domain. Some of the application of

AI in built environment – energy efficiency; predictive maintenance; Occupant comfort and well-being; Security and safety; Data-driven decision-making [19].

Blockchain

Adoption of blockchain technology makes the property records more secure and transparent. By storing property data on a decentralized ledger and reduce the risk of fraudulent. In addition, it ensures the integrity of ownership record for property. The innovation can help with transparency and trust among the stakeholders [41, 42].

4 Potential Digital Technology to Enhance Accuracy of Real-time Property Valuation – Discussion & Inferences

Various digital technologies can be adopted to enhance property valuation by automating extraction, sharing, and updating of factors affecting property valuation in accurate and efficient way. Therefore, this research maps digital technology enhancing various factors which affect the property valuation based on the hybrid method of review of research article from reputed journal and focus group discussion carried with five professional industry officials. The output of this study method is a matrix based on factors affecting property valuation and digital technology that can automatically apprehend evaluation of property valuation and enhance its accuracy and efficiency is listed on Table 1.

BIM provide relevant information requirements that transfer from design model to constructed building and then to operation and maintenance phase of property. During the phase of property important information regarding geometric and functional information of property can be extracted from BIM such as, building shape and size, location of the building, ownership, type of property, and property master plan, etc. other necessary information which are required can be attached to BIM model, so that it can shared efficiently when needed. At the end of the project delivery process, the information requirements are transferred in the form of property information management (PIM) which can support informed property valuation [26].

GIS play vital role in property valuation by providing spatial data and mapping capabilities [27]. GIS has improved the coverage and capture of built-up areas and improved the accuracy of geographical data, neighbourhood details, proximity to

amenities, and connectivity of the property which are very comprehensive details required for property valuation.

IoT technology brings a wide range of applications to property management. Through sensors, smart devices, and data analysis; property management can realize functions such as remote monitoring, smart and automated devices, and predictive maintenance [21]. These applications can improve operational efficiency, reduce costs, and provide a better user experience, thereby enhancing property value and can help with accurate valuation of the property based on actual data of property.

AI can be used to monitor and control the temperature, lighting, and other environmental factors in a property. It can also be used to monitor equipment and detect potential problems before they become serious issues. This can help to reduce maintenance costs and downtime, as well as improve the overall efficiency of property operations, thereby enhancing property value and leading to accurate property valuation predicted on actual condition of property based on operation & maintenance of property [16]. Predictive maintenance is the process of using data to predict when property element will fail and needs to be repaired or replaced. This is significant because it can help prevent element failures, which can lead to disruptions in service, thus impacting property value severely [17]. AI can also help with predictive analytics of market indicator and predict future price of similar building based on historic data. It can help to make informed decisions as per market trends.

AR can overlap property information, historic data and valuation estimates onto the real-world view through smart phone or tablet providing real-time information to the valuers at property site [28].

Big Data can harness vast and relevant information based on market analysis. This information can be related to property sales, demographics, market trends, and economic indicators leading to better accuracy and reliability of data for property valuations [45].

Table 1. Digital technologies enhancing accuracy of factors influencing property valuations.

Factors	**Digital Technologies**					
	BIM	**GIS**	**IoT**	**AI**	**AR**	**Big Data**
Qualified Valuer						
Purpose of Valuation						
Selected Valuation Methods						
Geographic Location	✓					

Type of property	✓					
Neighbourhood of property		✓				✓
Connectivity of property		✓				
Condition of property	✓		✓	✓	✓	
Master plan and bye laws	✓				✓	✓
Age and future prospect of property	✓		✓	✓	✓	
Market demand and prices	✓				✓	✓
Environment and Legal Restriction	✓	✓				✓

Source: Author's Computation

While the integration of various digital technologies brings significant advantages to real estate property valuation, it also presents challenges that must be taken into account, such as ensuring the accuracy and integrity of data sources with valid scrutiny process, privacy, information regarding property and its client information is of utmost importance and its very crucial to regulate its privacy and security. In addition, Valuers need to continuously skill themselves to effectively utilize digital technology for the purpose of accurate and transparent property valuation.

5 Summary and Conclusion

Property valuation is a critical aspect of real estate transactions and investment decisions. Conventionally, it is labour-intensive and error prone as it relies on manual inspection and data analysis. Adoption of digital technology can help eliminate tedious and fallacious issue relate to property valuation. BIM can be used enhance the efficiency of extraction and sharing of these factors - Geographic Location, Type of property, Condition of property, Master plan and bye laws, Age and future prospect of property, Market demand and prices, Environment and Legal Restriction. GIS can help with the information related to Neighbourhood of property, Connectivity of property, Environment and Legal Restriction. IoT and AI can be used enhance the accuracy of extraction and sharing of these factors - Condition of property, Age and future prospect of property. AR can automatically with visualization of various information related to property such as, Condition of property, Master plan and bye laws, Age and future prospect of property, Market demand and prices.

Through literature review and focus group discussion, it has been found that condition of the property is one of the essential aspects of property valuation and is still not strongly considered for automation in property valuation. During property valuation generally average condition building is considered, thereby inaccurate property value which can further leads to incorrect property price. Therefore, one of the potential future research areas is adoption of BIM, IoT and AI to enhance evaluation of property value by automating real-time condition monitoring and assessment, there by finding accurate property value.

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