THE USE OF BIG DATA IN PROPERTY STUDIES

Sekinat Olagoke-Salami & Gbemisola Akinola
(Department of Estate Management and Valuation & Department of Quantity Surveying)
The Federal Polytechnic Ilaro, Ogun State, Nigeria
sekinat.olagoke@federalpolyilaro.edu.ng; gbemisola.akinola@federalpolyilaro.edu.ng
08035459505

Abstract

Big data is generated and used in every field including real estate. The concept of big data has provided solutions to modern day challenges and a lot of people have adopted it in tackling numerous challenges unfolding in real estate profession. Big data is a method and technique to retrieve, collect, manage and analyze a very huge volume of both structured and unstructured data that is difficult to process using traditional database which entail new technologies and technique to analyze them. The study looks into the concept of big data with the aim of finding out its applications in real estate sector from literature analysis as well as discussing and interpreting the findings. The review shows the impact of the concept in real estate professions to include digitalization of records, forecasting property values among others. The study therefore concluded that big data need to be considered in other to make more accurate analysis which will lead to better decision making.

Keywords: Big data, Digitalization, Property, Real estate

Introduction

Big data is a collection of data that is huge in volume, yet growing exponentially with time. It is a data with so large size and complexity that none of traditional data management tools can store and process it efficiently (Taylor, 2022). They are data that exceeds the processing capacity of conventional database systems (Banik & Bandyopadhyay, 2016). Example of this is the use of social media platforms to analyse data of their followers on certain issues to get their perceptions.

Big data is the concept of enormous amount of data being generated daily in different fields due to the increased use of technology and internet sources (Munawar, Qayyum, Ullah, & Sepasgozar, 2020). Big data is generated and used in every possible field and walk of life, including marketing, management, healthcare, business and other ventures. Although the use of big data in technology and business is relatively new, many researchers are giving significant importance to it and found various useful methods and tools to visualize the data (Sagiroglu & Sinanc, 2013). It has affected the way that organisations do business in every industry across the world and real estate is no exception.
Dealings in real estate is a system of transaction between land owners, land users and estate managers (Olajide, Bello & Alabi, 2012). Estate managers are functionally and professionally expected to carry out the following: valuation for all purposes; project management and financing; property planning; development and management; formulation of various policies relating to land and; broad range of real estate consultancy services. All these requires the use of data which are sometimes huge and with the use of big data there will be accurate result in property appraisals, price predictions, risk mitigation and healthier selling and buying habit.

Big data is processing of large amounts of data, be it historic or real time and to which algorithms are applied to discover trends in user behavior, predict future outcomes such as trend in property values over a period of time, to track and predict consumer behavior or join other business insights. Sagirolu and Sinanc (2013) posits that big data describes large amount of data, which are structural, semi structural and substructural data which can be exploited for information purposes while large data do not contain any specific amounts.

The concept of big data though relatively new has brought a lot of solutions to modern day challenges, many authors in developing countries, have adopted the concept in tackling the numerous challenges unfolding in real estate profession (Oluwunmi *et al*, 2019). It is very important for real estate enterprises to take full advantage of big data because of the status of real estate industry as a pillar industry of the national economy. Especially when property prices continue upward or property bubble inflation involves the national economy and people's livelihood, the real estate enterprises should make effective use of big data to tap the potentials.

Aim and Objectives

The aim of this study is to examine the use of big data in property studies.

Objectives

- To examine to concept of big data.
- To define the character of big data.
- To assess the usefulness of big data in real estate profession.

2. Literature Review

Concept of Big Data

Digital data is generated when smartphones, tablets and computers are connected to the internet hence data are transmitted about the owners of these devices. Connected smart objects convey information about consumer's use of everyday objects. Riahi and Riahi (2018) opines that apart from the connected devices to the internet, data come from a wide range of sources: demographic data, climate data, scientific and medical data, energy consumption data, etc. and all these data provide information about the location of users of the devices, their travel, their interests, their consumption habits, their leisure activities, and their projects and so on. Information on the use of infrastructure, machinery and apparatus are also provided through these means.

The term "Big Data" refers to the evolution and use of technologies that provide the right user at the right time with the right information from a mass of data that has been growing exponentially for a long time in our society (Munawar *et al*, 2020). Big data is a term for large and complex sets of data in which traditional methods of processing data are insufficient (Zulkarnain & Anshari, 2016). The excessive use of Internet will increase by Internet of thing (IoT) due to the integration of all objects via embedded systems leads to a high distribution of network of devices communicating with people as well as other devices. From these networks of devices, huge portions of raw data can be generated and stored as big data. This data comes from anything and anywhere such as customers, smart mobile devices, sensors, purchase transaction records, social media, digital images, CCTV, GPS, audio that can be used to gather specific information (Xia, Yang, Wang, & Vinel, 2012). The term "big data" can be hardly defined yet there are attempts to define it. One definition about big data is that it refers to sets of data where their size is too advanced, too complex for typical data software tools to use their abilities for analysis or management etc. (Manyika *et al*, 2011).

Big data is defined as a massive amount of data, very quickly in processing from many different forms to support decision making (Hashem *et al*, 2015). Although there are many definitions of big data, almost all of them have three common features: big data volume, data processing speed and data coverage (Xia *et al*, 2012). Madden (2012) neatly summaries big data as data that is "too big, too fast, or too hard for existing tools to process"— too big as organisations are now collecting petabytes of data, too fast as processing applications must provide nearly instantaneous results, and too hard when new technologies are required to analyse it.
One of crucial areas in real estate where big data analytics can be applied is an assessment of the real estate market. With the help of big data large volumes of potential buyers' data based on age, financial condition, location characteristics among others can be analyses and a proper marketing strategy can be developed to suit the targeted audience and the set out goals of the estate manager. Real estate transactions before are usually based on first impression and hearsay which most times doesn't give accurate results.

Characteristics of Big Data

According to Zulkarnain and Anshari, (2016) the term Big Data possesses three characteristics which are: gigantic larger datasets (volume); more diversified, including structured, semi-structured, and unstructured (variety) data, and arriving faster (velocity) than before. These are the 3V.

- Volume: represents the amount of data generated, stored and operated within the system. The increase in volume is explained by the increase in the amount of data generated and stored, but also by the need to exploit it.

- Variety: represents the multiplication of the types of data managed by an information system. This multiplication leads to a complexity of links and link types between these data. The variety also relates to the possible uses associated with a raw data.
- Velocity: represents the frequency at which data is generated, captured, and shared. The data arrive by stream and must be analyzed in real time.

However Rouse, Botelho & Bigelow (2019) reported that big data is made up of six dimensions which are: volume, variety, velocity, veracity, value and variability. They added three other characteristics to the ones suggested by Zulkarnain and Anshari (2016) and explains the six dimensions as:

- Volume: This data is presently quantified in petabytes, which presents unique storage management challenges; it is anticipated that in the near future the size will increase to zettabytes. This is because of the expanded utilization of cell phones and also the use of social media
- Velocity: This reference both the rate of collection of data and the rate of data flow. The methods of traditional analytics simply cannot accommodate large real-time data; this presents a problem in the face of growing dependence on live data.
- Variety: The collected data is available in numerous formats with some parts unstructured and others structured; this is so since it (data) is captured from multiple sources – the web, sensors, email, texts, etc. The sheer volume is the cause of the failure of traditional methods of analytics in the management of big data.
- Veracity: Ambiguity - typically from noise and abnormalities within the data - is the focus in this dimension.
- Value: The business value of the data collected
- Variability The various formats and uses of big data

Usefulness of Big Data

There are many benefits of big data. Zulkarnain and Anshari (2016) highlighted four benefits of big data. Firstly, an organization come up to more accurate information as big data can discover value, connections, trends, and pattern. Secondly, it improves decision making process since it is richer in term of data gathering. Thirdly, big data can reduce the maintenance costs. A certain type of equipment is likely to wear out after years, so it costs a lot to replace every technology, even the important files or documents are left in them. Forth, it improves customer service since an organization can understands customer's preferences.
Fisher *et al* (2012) and Sravanthi & Reddy, (2015) identified the following as some of the facets of the importance of big data in different fields:

- Finance: When assessing new applications, a major financial institution has reluctantly used third-party credit scoring. The bank now conducts its own loan score analysis with a wide variety of data, including checking, saving, credit cards, mortgages, and investing data, for existing customers.
- Banking: Security problems arise from the use of customer information continuously. Big data scrutiny could possibly discover delicate individual data by disclosing hidden links between apparently irrelevant pieces of data. Studies have shown that sixty-two percent of financiers always take precautionary measures whenever they utilise big data. In addition, re-appropriating exercises to investigate information or disseminating customer information across divisions to generate more important information also improves risks to security.
- Agriculture: A biotechnology company engages the use of data from sensors to optimize crop efficiency. It plants crops to test and simulates how plants react to different conditions. They test crops. Its database environment constantly adapts to changes in the attributes of the different data it collects, including temperature, water levels, composition of the soil, growth, production and genetic sequence of each plant. These simulations enable them to detect the ideal environmental conditions for particular gene types.

Problems associated with big data

The concept of big data is related to both the data themselves and the adaptation of different technologies for their collection, storage, analysis and visualization (Fisher *et al*, 2012). The data sources are many and varied in their

essence. However, not all collected data are useful for the business. Companies that lack data differentiation have problems in identifying and retrieving components that are related to the company's current and future goals (Rouse *et al*, 2019). The lack of such resources leads to the risk of missing valuable information that can improve their final results and better position them in the competitive market.

Also, the development of a strategy to deal with data flows can be a huge advantage. Each of the features of big data (volume, velocity, variety, veracity and value) leads to multiple interrelated problems that require a proactive strategy. For example, data collection and storage are interconnected, because a large amount of data can be collected only when the storage capacity is rapidly developed. Most companies collect as much data as they can store. Cloud-based storage options alleviate some of these problems. When changing the data collection needs, their storage can be adapted relatively quickly to meet the new requirements.

Another problem is related to data analysis. It is often exacerbated by difficulties, related to the staff. Until recently, there has been a clear distinction between IT and computer support personnel and property management activities. Currently, lots of companies are seeking to hire professionals, who have technical skills and expertise in the sector to analyze, evaluate, interpret and extract the value of big data. Smaller companies, that do not have resources to hire such specialists, can benefit from multiple cloud services that offer computational operations. In this way, large data sets can be stored and analyzed remotely.

Even though applications and the potential of big data is substantial, there are of course challenges that would occur regarding big data. The main challenge is issue of privacy and confidentiality (Zulkarnain & Anshari, 2016). Furthermore, big data can be shared, integrated, and mined to give people a deeper understanding of the status of smart real estate operations, help them make more informed decisions for renting or purchasing residential or commercial spaces. Thereby, optimizing the allocation of urban resources, reduce the operational costs, and promote a safe, efficient, green, and intelligent development of the smart real estate and cities as a whole using the seven Vs (variety, volume, variability, value, visualization, veracity, and velocity) of big data.

Big Data and its Importance in Real Estate

Real estate as an industry, academic discipline and asset class has always been centred on data – lease and vacancy rates, home price indices, lot sizes, interest rates, REIT returns, etc. According to Winson-Geideman and Krause (2016) real estate data traditionally comes in three broad types namely financial, transactional and physical. He opined that financial data includes information on REIT shares and real estate-related stocks. Transactional data refers to information on real estate purchases, mortgages, leases, expenses, taxes and general financial returns to a development or portfolio of developments. Physical data, conversely, includes information as to the actual real estate land or structure itself, such as property structural characteristics and locational data.

Although, with the introduction and proliferation of Geographic Information Systems (GIS) in the 1990s, new forms of data could be efficiently utilized in the real estate industry because GIS allowed for extra-locational spatial data to be collected, quantified and analyzed. In this case, "extra-locational" means information on spatial phenomena outside of the physical boundaries of a property. Whereas GIS broadened our abilities to measure and analyse the static, physical world surrounding our real estate, Big Data seeks to pull in the fugacious, human and psychological aspects as well.

In the aspect of property management big data have the potential to be a major incentive for evidence-based decision-making. According to Stoyanova *et al* (2021) the usefulness of big data in property management can be categorized in two interrelated areas: operational efficiency improvement and effective use of big data for attracting and retaining customers.

As for operational efficiency improvement, in many cases, the big data generated by the Internet and Things (IoT), provide the greatest opportunities for the property sector. The Internet of Things is a merger of multiple technologies that produce continuous streams of data, interacting with each other over the Internet. Wireless communications, GPS, smart buildings and machine learning are part of the Internet of Things. For example, the location of sensors in buildings provides information on their use and energy consumption. All this information generates a new generation of smart buildings and smart systems that achieve much greater functional efficiency. The data collected by these systems are analyzed in real time. The analysis is relatively simple, because the data are most often in a structured format. This makes the forecasting of data for building systems very reliable. Additionally, this technology expands

the infrastructure of smart buildings in a way that allows them to be part of a larger network, representing smart campus or even smart city (Diehl, 2017). However, the greater degree of interconnectivity is cost-related, as buildings become more vulnerable to cyber attacks that disrupt or disable entire systems (In this regard, risk management, especially with regard to technology, is becoming a major problem for companies that are victims of such activities. The higher the dependence on Internet of Things in terms of rationalizing operations and improving efficiency, the greater the need for cybersecurity.

For Attracting and retaining customers, this is required for the end results of investors. In the age of big data, it is related to focusing on efficiency and performance, caused by the use of integrated systems for heating, ventilation and air conditioning (HVAC) and network security systems. Creating and maintaining spaces, that improve the customer experience by increasing productivity and developing a cohesive working environment, are examples of the potential benefits of big data. Much of this potential is due to the constant use of mobile phones.

Olawunmi *et al* (2015) pointed out that big data is useful in the area of digitization of records. Digitisation simply implies the conversion of hard copy documents into soft copies on a computer system. It can enable real estate firms reduce paper work and optimise space in their offices. Documents such as valuation reports, rent reminder letters, feasibility study reports etc. can all be stored as soft copies on a system. By having records stored on a computer, they can easily be accessed anywhere with the use of a hard drive, email and even an online computer storage unit.
Big data is also useful for forecasting Property Values. This involves the use of predictive analytics. The predictive analytics makes it possible to forecast the value of properties in a given area. Big Data makes this possible by permitting the tracking of property value trends, real-time rental and purchase demand as well as the growth of lifestyle establishments in the locality. All this information is collected during time intervals and then further analyzed using the predictive analytics to ascertain the real property values.

Automated Property Appraisals is another area where big data can be used in real estate. Big data can be used to provide an instant indication of real estate, through the use of automated valuation models (AVMs). This is particularly useful on the credit side, which has a debt service coverage ratio as an important but secondary input into the bonding process. The credit to value is a leading indicator. Automated valuations are capable of providing a precise and immediate balance-sheet assets reassessment to banks, insurance companies, pension funds and other institutional investors and creditors, thus avoiding the need for a long and expensive annual (or quarterly) revaluation process, which regulators increasingly need. In times of market volatility, an instant assessment of the book's market value is especially useful.

3. Conclusion

With the use of technology data can be easily generated from various digital tools connected to the internet. Big data due to its capabilities to gather huge data at a speed with high level of accuracy can be applied to crucial areas in real estate such as market assessment to determine the trend in rental/capital values of properties, consumer behaviour, future transaction based on consumer behaviour among others. The study therefore concluded that big data need to be considered in other to make more accurate analysis which will lead to better decision making. Also, there is need for further research on big data application and uses in real estate as this can generate more accurate and reliable information on real estate market assessment and also generate profits and improve efficiency of real estate sector.

References

Banik, A., & Bandyopadhyay, S. K. (2016). Big data-A review on analysing 3Vs. *Journal of Scientific and Engineering Research*, *2*(1).

Diehl, D. (2017). Beyond 72 Degrees and Sunny Inside: Optimizing the Indoor Work Environment, Development Magazine. Available at: https://www.naiop.org/en/Magazine/2017/Summer-2017/BusinessTrends/Optimizing-the-Indoor-Work-Environment.

Fisher, D., DeLine, R., Czerwinski, M., & Drucker, S. (2012). Interactions with big data analytics. *Interactions*, 19(3), 50–59.

Hashem, I. A. T., Yaqoob, I., Anuar, N. B., Mokhtar, S., Gani, A., & Khan, S. U. (2015). The rise of "big data" on cloud computing: Review and open research issues. *Information systems*, *47*, 98-115.

Madden, S, (2012). From databases to big data. *IEEE Internet Computing*, 16(3), 4-6.

Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). *Big data: The next frontier for innovation, competition, and productivity*. McKinsey Global Institute.

Munawar, H. S., Qayyum, S., Ullah, F., & Sepasgozar, S. (2020). Big data and its applications in smart real estate and the disaster management life cycle: A systematic analysis. *Big Data and Cognitive Computing*, 4(2), 4.

Olajide, S. E., Bello, K., & Alabi, O. (2012). *Elements of estate management and property valuation*. Lagos, Nigeria: Abisam Prints.

Oluwunmi, A. O., Role, B. A., Akinwale, O. M., Oladayo, O. P. & Afolabi, T. O. (2019). Big data and real estate: A review of literature. *Journal of Physics: Conference Series.* 1378(3), 032015.

Riahi, Y., & Riahi, S. (2018). Big data and big data analytics: Concepts, types and technologies. *International Journal of Research and Engineering*, 5(9), 524-528.

Rouse, M., Botelho, B., & Bigelow, S. J. (2019). Big Data Available @ https://searchdatamanagement.techtarget.com/definition/big-data. retrieved on 22nd August, 2021

Sagiroglu, S., & Sinanc, D. (2013). Big Data: A review. *In 2013 international conference on Collaboration Technologies and Systems (CTS)*, 42-47. IEEE.

Sravanthi, K., & Reddy, T. S. (2015). Applications of big data in various fields. *International Journal of Computer Science and Information Technologies*, *6*(5), 4629-4632.

Taylor, D. (2022). What is Big Data? Introduction, Types, Characteristics and Examples. *Preuzeto*, 30, 2022.

Winson-Geideman, K., & Krause, A. (2016). Transformations in real estate research: The big data revolution. In *Proceedings of the 22nd Annual Pacific-Rim Real Estate Society Conference, Queensland, Australia* (pp. 17-20).

Xia, F., Yang, L. T., Wang, L., & Vinel, A. (2012). Internet of things. *International Journal of Communication Systems*, 25(9), 1101-1102

Zulkarnain, N., & Anshari, M. (2016). Big data: Concept, applications and challenges. In International *Conference on Information Management and Technology (ICIMTech)*, 307-310. IEEE.