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# BIG DATA AND REAL ESTATE: A REVIEW OF LITERATURE

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## Abstract

The concept of big data though relatively new has brought a lot of solutions to modern day challenges. Many authors, particularly in developed countries, have adopted the concept in tackling the numerous challenges unfolding in the real estate profession. However, most of the findings from these authors are on individual bases and as such, there is a need to reach a general consensus on the relevance of big data to the real estate profession. The review shows the impact of big data to include digitization of records, information on user preferences, sensor information on the urban environment and sensor information on movement. The paper concludes that the relevance of big data to the real estate profession cannot be over-emphasised.

**Keywords:** Application, Big Data, Concept, Real Estate, Profession

## 1. Introduction

Data is an essential ingredient of our present economy. People from different fields rely so much on it that it has pervaded their personal and social lives. The phrase "big data" was formed to depict massive, interconnected databases and the procedures employed to extract knowledge from the tide of data in existence [1]. Big data describes large amounts of data, which are structural, semi-structural and sub-structural data, which can be exploited for information purposes. While large data do not contain any specific amounts, this term is frequently used when talking about bytes and exabytes of data [2].

The information derived from analysing big data can alter the manner in which we undertake research, real estate research inclusive. Big data has brought about a lot of positive impact in the real estate profession, such as solving the challenges evolving in the profession. This is evident in the report of [3] that big data has provided a great support for property development in China. It helps property companies to implement diversified investments by reminiscent of potential worth data. Digital personal data and revolutionary thinking changes create new opportunities for real estate companies to grow innovative investments in this age. Likewise, big data has been of use in forecasting house prices, as indicated by [1] who derived the prices by analysing internet searches and media reports. Additionally, [4] displayed the efficacy of big data in the creation of models. They performed an analysis of search trends on Google and used the result to create a house-prediction template or model which was more accurate than predictions from the National Association of Realtors by a significant margin of over 20%. It is apparent from the above that several research projects have been conducted on big data and real estate profession in developed and developing countries of the world; however, in Nigeria, there is still a paucity of research. Moreover, most of the research findings are based on individual findings/opinions. This review therefore seeks to harmonize the various findings. It is based on the foregoing that this study reviewed articles on the concept, importance and application of big data in real estate profession.

The paper is organized as follows: section one is the introduction; section two is the methodology used in the review; section three is about the articles reviewed on the concept of big data, importance of big data and application of big data in the real estate profession; section four is on the major findings from those articles and section five is the conclusion.

## 2. Methodology

For the purpose of this review, the authors focused on materials that are related to the concept of big data, dimensions of big data, importance of big data and application of big data in the real estate profession. The authors then summarised the major findings of the articles reviewed.

### 3. Literature Review

#### 3.1 Concept of Big Data

Big data, as the name implies, comprises of data that is quite large in nature contained in different data sets. Relatively, there is no precise definition of 'big data' [5] and views of what it comprises change not only from one field of study to another, but also amongst stakeholders in industry [6]. Madden [7] explained big data by saying that it is data that is "too huge, too quick, or unreasonably hard to handle by existing devices" — too huge, as associations are at present collecting information in petabytes, too quick as application processing needs to deliver immediate results and too hard to examine. Dumhill [8] further clarified that big data can be identified as data that surpasses the working capability of old computer devices. The data is extremely large, travels quickly, or does not gibe with the structures of conventional computer database frameworks. To obtain value from the data provided, alternative ways to process it must be sought.

According to [9], big data is based on the following:

- a) Technology: continual improvement of algorithms that capture, compare and otherwise analyse huge data sets, and also boosting of hardware compute power.
- b) Analysis: searching huge data sets for the identification of patterns that may be used to support theories or claims of an economic, technical or legal nature.
- c) Mythology: the widely-held belief that access to huge data sets heralds a higher intelligence which can accurately and objectively yield insights hitherto unattainable.

Mayer-Schönberger and Cukier [10] stated that big data is a remarkable development that brings three major change in the way we analyze information that transform how we understand and organise society; (a) more data, (b) messier (incomplete) data and (c) correlation overtakes causality. Microsoft [11] analysed big data as the procedure involving the application of serious computing power, the most recent in machine learning and artificial intelligence, to enormous and very complicated types of information. International Business Machines Big Data and Analytics Hub [12] emphasized that big data is made up of four dimensions; however, according to [13], big data is made up of six dimensions as shown in Table 1.

**Table 1.** Big Data Dimensions.

S/N	Big Data Dimensions	Focus
1	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
2	Velocity	This references 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.
3	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.
4	Veracity	Ambiguity - typically from noise and abnormalities within the data - is the focus in this dimension
5	Value:	The business value of the data collected
6	Variability	The various formats and uses of big data

Adapted from International Business Machines Big Data and Analytics Hub (2014) and Rouse, Botelho and Bigelow (2014)

### 3.2 *Importance of Big Data*

Several authors have examined how big data has affected different fields of study ranging from healthcare, to engineering, transportation, agriculture and many more. Prominent among these authors are [14, 15, 16] that identified the following as some of the facets of the importance of big data in different fields:

#### *A. Data Mining*

The Datameer's decision trees naturally help customers to understand what mix of information is an ideal result. Decision trees define connections and conditions within information and regularly identify the consequences of normal characteristics, such as malnutrition, extortion risk, purchases and the online exchange of information. The structure of the decision tree reflects the structure that your information conceivably covers.

#### *B. 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.

#### *C. 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.

#### *D. 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.

#### *E. Economy*

Designed from scratch to handle commodity hardware intelligently, Hadoop can enable associations to change to cheaper servers.

#### *F. Credit Cards*

Credit card companies rely on the speed and accuracy of in-database analytics to identify possible fraudulent transactions. By storing years' worth of usage data, they can flag atypical amounts, locations, and retailers, and follow up with cardholders before authorising suspicious activity.

#### *G. Agriculture*

A biotechnology company engages the use of data from sensors to optimise 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.

### 3.3 *Application of Big Data in the Real Estate Profession*

Prominent authors that have identified the relevance of big data in the real estate profession are [1, 17, 18, 19]. The areas identified by these authors are stated below:

#### 3.3.1 *Digitisation 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.

### 3.3.2 *Information on User Preferences*

These include consumer platforms e.g. Amazon, Zillow's property listings, Yelp restaurant reviews and bookings, and on Facebook. Availability of such information enables consumers to recognize easily, for example, which kind of property they would desire or the type of commodities they would most likely purchase over the internet. This can deliver useful information when ascertaining the value of real estate in connection with geographies.

### 3.3.3 *Sensor Information on the Urban Environment*

Sensors can be utilized to recognise certain things, for example, the number of inhabitants in a specific area, the dimension of noise and furthermore the level of contamination, all of which can render helpful data in connection to property estimations. Recognisable proof of development, groups, and social events can supply data on the kind of exercises occurring in a specific neighbourhood, a precedent being if individuals engage in shopping activities, feeding at open air eateries, or strolling in a specific direction.

### 3.3.4 *Sensor Information on Movement*

This can be obtained from networked cars and mobile systems, as well as public transport systems. Although privacy problems exist, mobile sensors would allow individuals to be tracked throughout a city. Motional understanding offers significant information when analysing data sets that can break down demographic trends of usage and social activity. Identifying motion trends in a town, such as knowing that a certain population continues to operate in a specific place A, and moving to distributors and hotels in place B at certain moments of the day, is helpful in determining where fresh trends can be discovered and how transport is influenced. The data type being utilised here can be employed to discover trends, as you can see if millennials move in real time to cooler areas.

### 3.3.5 *Identification of Risks in Construction Projects*

Big data can be employed to evaluate the danger of building structural misfunctions, for example owing to harms from a seism. Because of variables that influence customer supply, users may also be at danger. Big data on customer organizations such as locators and end clients, hotels, housing properties and departments provide information about personal threat features that can be used to define company asset hazards in a town. Such type of data is beneficial for several participants, such as immobilizers, creditors and town authorities. Data on business operations in and around an immovable is fascinating because with other concentrations of socioeconomic information they can better forecast tenant and end-customer hazards. For instance, data about the retail tenant's client can be helpful in predicting estate owners' hazards. For instance. This sort of data can be used to evaluate property danger from a volatility in lease revenue that therefore determines the importance of the property.

3.3.4 Sensor Information on Movement

### 3.3.6 *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.

### 3.3.7 *Project Reporting*

Big Data enables the accurate reporting of every aspect of the project ranging from labour performance and construction quality to asset maintenance and budget spirals high budgets complex construction cycles exhaustive inventory management and mass labour inputs. It provides effective means to ensure

that any type of construction project is carried out in the proper manner and also ensures that the budget set out is enough to complete the project.

### 3.3.8 Geographic Information Systems

As a result of the implementation and development of GIS, fresh types of information could be used efficiently in the actual property industry in the 1990s. GIS allows for the gathering, measuring and examining of extra-locational space information. In this situation, "extra-locational" implies data on spatial events beyond the physical boundaries of a property. This varies from the transactional and physical data listed above, which only contain property information. Spatial assessment and company history became feasible actual property companies with extra-locational data and progressively became the standard in property assessment.

### 3.3.9 Automated Property Appraisals

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.

### 3.3.10 Crowdsourcing

Crowdsourcing is a form of data collection where a large number of people, often volunteers, produce data collectively on particular issues. Crowdsourced data mobilizes citizens and generate information that may creatively address the different real estate problems in a particular city as well as bring forth innovative ideas to solve such problems and provide benefits to residents within such community. These can prevent long-term declines in property values and/or generate local growth.

## 4. Findings

Major findings from the articles reviewed on the relevance of big data to the real estate profession is summarised in Table 2:

**Table 2.** Application of Big Data in the Real Estate Profession

S/N	Authors	Application of Big Data in Real Estate Profession
1	Winson-Geideman and Krause (2016)	GIS
2	Manohar and Anusha (2016)	Forecasting property values and Project reporting
3	Nils, Eija-Leena and Carmen (2017)	Automated Property appraisals
4	Herman, Kent, and Michael (2018)	Information on user preferences, Digitisation of records, Sensor information on the urban environment, Sensor information on movement, Identification of risks in construction projects and Crowdsourcing

## 5. Conclusion

This study has reviewed articles on the concept of big data and its impact on the real estate profession. The paper has been able to harmonize the findings from the different researchers in developed and developing countries. The authors identified ten different areas where big data can be applied. It is evident from this study that the relevance of big data to real estate profession cannot be over-emphasized.

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