

Exploring the potential of big data and data analytics in South Africa's real estate sector

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ABSTRACT

This paper examines the current applications, barriers, and potential uses of big data and data analytics in the South African real estate market. A qualitative approach was adopted to administer semi-structured interviews to big data and data analytics specialists in the South African real estate market. The results show that the proptech market is still in its infancy in general and that the big data and data analytics submarket is limited in the South African real estate market. Major challenges include the lack of clarity or knowledge of adequate value proposition related to upscaling, supportive ecosystem, storage systems, costs, and the scarcity of technical skills needed for big data and data analytics to blossom. Besides these issues, anecdotal evidence, showing the presence of active companies focusing on big data, and responses from research participants, suggest that big data and big data analytics can grow and potentially bring immense benefits to all stakeholders in the country.

Keywords; Real estate market, proptech, big data, big data analytics, South Africa

INTRODUCTION

In the history of human progress, various technologies have been credited for improving efficiency, reducing costs of production, and improving customer experience (Pettit et al., 2018). Within the real estate market, Property Technologies, commonly known as proptechs, involve broadly the integration of data and technology with property. This leads to efficient processes in the sale and use of buildings or properties, thus creating value for users or owners of real estate (Pettit et al., 2018). These recent technological and digital innovations include big data, blockchain, artificial intelligence, big data analytics, and sensors (Baum et al., 2020).

As a sub-component of the proptech sector, big data is often defined by its characteristics as well as computational processing abilities. Big data has three basic characteristics, that is, volume, variety, and velocity (Winson-Geideman & Krause, 2016), and its emergence is attributed to the Internet of Things (IoT) and cloud computing (Du et al., 2014). Big data, thus,

has a strong link to information technology and employs tools like search algorithms and cloud computing. Its usefulness is most noted in markets where marketing and information are analysed, including the real estate market (Pyle et al., 2017). Through appropriate big data analytics (i.e., digital data management, data analysis, and data visualisation), the real estate market can harness daily activity data for more practical uses (Bhavna, 2018; Baum, et al., 2020; Herman et al., 2018; Barkham et al., 2018; Davenport & Dyche, 2013).

In South Africa, the big data and data analytics category of the proptech market is identified as having one of the highest levels of innovation and is expected to influence the real estate market in fundamental ways (Godoy & Boyle, 2019). As elsewhere, most of the existing literature on big data in South Africa is focused on the development of systems and technical algorithms, with limited research on practical applications (Godoy & Boyle, 2019). Clark and Marshall (2023) identified 11 big data and big data analytics companies. Ridge et al., (2015) assessed the use of big data analytics in the retail industry and found the limited or no use of big data analytics. To contribute to the literature, this paper investigates by probing the following questions to experts in the big data and big data analytics sub-market in South Africa:

RQ1: What is your understanding of the meaning of big data and big data analytics?

RQ2: What is the current state of big data and data analytics use in the real estate sector

RQ3: What are the barriers to using big data and data analytics in the real estate sector; and

RQ4: What is the value of using big data and data analytics in the South African real estate market?

The paper is structured as follows. After the introduction, Section 2 reviews related literature, including the adoption of big data and its use in the real estate market, and barriers to the application of big data in real estate markets. Section 3 describes the research approach, while Section 4 dwells on results and related discussions. The last section concludes the paper.

PROPTech, BIG DATA, AND DATA ANALYTICS IN THE REAL ESTATE MARKET

The proptech sector has grown phenomenally since its emergence mainly in the United States of America (USA) and the United Kingdom (UK) (Baum et al., 2020). It has gone through four phases: *Proptech 1.0* focused on the development and sale of software, such as property management software, for analysing the real estate market and related services (Snow 2023); *Proptech 2.0* involved digitalisation of real estate systems that allowed online marketing platforms in commercial real estate transactions; *Proptech 3.0*, occurring towards the end of 2007, took advantage of the dawn of the new mobile computing era placing the user experience at the centre, where cloud provider hosts applications and makes them available to end users over the Internet; and *Proptech 4.0* has introduced advanced systems and applications that are mobile-responsive for the end-user and cloud-based solutions and may not require human interpretations (Baum et al., 2020; Snow, 2023).

Consequently, big data, as a component of proptech, is either generated or processed in each step of the proptech pipeline to create value for users or owners of real estate by facilitating negotiation, management, and financing of real estate investments. With big data increasing in importance in the real estate market, it has become a tradeable commodity and the central resource of the digitalised real estate markets (Braesemann & Baum, 2020). Big data has been brought to the forefront by the increase in the volume of data that has been accelerated by the advancement of computer and internet technology applications (Du et al., 2014). The most common understanding of big data is derived from its characteristics, the 3 Vs of big data management dimension: velocity, volume, and variety (Madden, 2012; Chen & Zhang, 2014; Kitchin & McArdle, 2016). According to Oluwunmi et al. (2019), as the field has evolved, there have been additional Vs that include veracity, value, and variability.

A significant part of big data is closely related to big data analytics which involves the application of predictive, descriptive, and prescriptive statistical models to offer direction in driving decision-making. These analyses are in various economic sectors, including healthcare (e.g., Luo et al., 2016), transportation (e.g., Neilson et al., 2019), agriculture (e.g., Kamilaris et al., 2017), aviation (e.g., Chinchankar & Shaikh, 2022), finance (e.g., Pejić Bach et al., 2019), e-commerce (e.g., Akter & Wamba, 2016), banking (Nobanee et al., 2021), cyber security (e.g., Ullah & Babar, 2019), credit bureau (e.g., Onay & Öztürk, 2018), enterprise decision making (e.g., Ko'oscielniak & Puto, 2015), and engineering (e.g., Chiang et al., 2017).

Clark and Marshall (2023), in their study commissioned by the South African Property Owners Association (SAPOA), identified 150 companies that operate in the South African proptech market broadly, and only a few companies were confirmed to be active in the big data and data analytics sub-market. So far, only Ridge et al. (2015) assessed big data analytics in the retail industry in South Africa and found limited or no use of the data analytics since the focus remained on existing structured data, rather than semi-structured or unstructured data. The limited use fails to leverage the benefits of increased processing speeds to advance conventional analytics that big data brings. This shows that the big data and data analytics sub-market in South Africa is nascent. For instance, Fetch Analytics poses consumer data comprising of origin-destination shopping trips to malls, socioeconomic characteristics (e.g., demographics, income, living standard measures, education), and shopping patterns (e.g., number of visits, types of purchases, amount of spending). When triangulated and analysed these consumer big data can unravel the relationships between existing sales, customer characteristics, and consumer locations. Other companies in the big data and big data analytics submarket in South Africa are Lightstone (www.lightstone.co.za), TPN (mrisoftware.tpn.co.za/), Activeeye (www.activeeye.co.za/), Gmaven (www.gmaven.com/), vizibiliti (<https://vizibiliti-insight.com/>), CMA Info (www.cmainfo.co.za/), 1Map (www.1map.co.za/), listio (<https://listio.com/>), and rebase (www.rebasedata.com/).

However, in the literature, several barriers are identified as impeding the application of the real estate market. Issues and challenges presented by Vistro et al. (2020) relate to security and privacy, incompleteness, heterogeneity, and storage. *Security and privacy* are related to

customers' and organisations' personal information which may be compromised or used without their permission (Michael & Miller, 2013; Mohanty et al., 2013). If this personal information is accessed by hackers, there could be serious consequences for the individual or organisation. Issues of *heterogeneity and incompleteness* refer to the data being incomplete due to malfunctions or faults in the system. This may result when data are being collected from different sources that vary in technical architectures (Sun et al., 2013). The *lack of trust* in employing and analyzing big data relates to the perceived fear of new technology solutions notwithstanding their potential ability to bring improved business processes. In addition, the misuse of big data by multinational corporations, such as social media companies, has fuelled people's mistrust of the use of big data. Fears of a data monopoly can also prevent the necessary investment into innovation and hold back change (Thakuriah et al., 2017). Other barriers to adopting big data analytics are the *shortage of technical literacy* in the industry and the *lack of understanding of new technological solutions* as well as *organisations not willing or able to allow access* to data (Braesemann & Baum, 2020). This gives rise to data being monopolised; holding back collaborations, innovations, and change. The *lack of a collaborative attitude* between real estate organisations is also a hindrance to the use of big data. Real estate organisations usually treat their internal information as confidential, and this unwillingness or inability to share their data holds back collaborations (Baum et al., 2020).

RESEARCH METHODOLOGY

The researchers purposively selected respondents who worked in the companies currently active in the big data and big data analytics sub-market. Out of the 11 potential respondents approached only five respondents were willing to participate in the study. Table 1 shows respondents' positions and the length of their work experiences in big data and data analytics. All the respondents had more than a decade in the data analytics sub-market of the proptech market. The sample size represents an adequate spread of opinions of the few specialists in different companies in the industry in South Africa (Guest et al., 2006; Marshall et al., 2013). As a homogeneous sample, this sample size achieved a data saturation point or the point where the researchers were no longer able to obtain additional information from participants (Dworkin, 2012; Alsaawi, 2014; Guest et al., 2006; Marshall et al., 2013). The researchers administered in-depth interviews through online semi-structured questions through Zoom and Microsoft Teams (see Annexure A for the set of semi-structured interview questions). Open-ended questions allowed for more probing and follow-up questions.

Table 1. Interview respondents' details

Respondent	Position	Years of experience
R1	Chief Executive Officer	14+
R2	Head of Data Analytics	18+
R3	Product Manager	11 +
R4	Senior Data Analyst	15+
R5	Managing Partner	12+

With the achieved sample size, steps were undertaken to ensure the validity and reliability of the collected data. First was that the sample size represents a spread of expert opinions in the few available companies in the proptech sector's big data and data analytics sub-market in the country. And as the questions posed were objective, responses were objective as well. Triangulating responses allowed respondents to offer validity and accuracy of their responses (Creswell and Creswell, 2018). The researchers mitigated biases and maintained reliability by meticulously documenting all steps of the procedures as accurately and in detail as possible. This included accurate transcribing and checking of transcription for clarity as much as possible (Creswell and Creswell, 2018).

RESULTS AND DISCUSSIONS

Defining big data and big data analytics

Some respondents acknowledged that there is no single definition of big data. Similar to the existing literature (Madden, 2012; Chen & Zhang, 2014; Kitchin & McArdle, 2016), the ambivalence of the definition of big data varies according to one's knowledge as evident from the respondents. Probed to provide a definition¹, R2 acknowledged the various interpretations and definitions of big data. Acknowledging the main characteristics of big data, which are volume, velocity, and variety (Winson-Geideman and Krause, 2016), R2 noted:

"Our current data business solutions probably do not qualify as big data. We work with exceptionally large volumes of data, but it is received and managed on a cadence that I would not consider to be of the frequency that you are talking about. But we do receive and manage enormous databases of many millions of rows" (R2)

Some respondents understood big data as it relates to the characteristics of variety and volume only, with no mention of velocity of the data. R3 stated:

"Big data is data that contains a huge variety of data points (values or events) and sometimes arrives in increasing volumes" (R3)

In addition, respondent states that without the analytics big data would not be useful. R3's definition of big data analytics is quoted below:

"Big data analytics is a process of using predictive and analytical models to discover trends and patterns and explore correlations of events from huge amounts of raw data to help decision makers make informed decisions" (R3)

The current state of big data in the South African real estate market

Most of the respondents agreed that there is little evidence suggesting that big data is used in the South African real estate market. Rather the data that is considered "big data" and being used in the real estate market is rather "large sets of data" or "large amounts of data".

¹ Respondents were briefed that big data is characterised by the 3Vs (Volume, Velocity, Variety) as well as the additional Vs (veracity, value, and variability).

The respondents agreed that the data is received and managed on a cadence (thus missing the velocity character), so it cannot be defined as big data.

R1 argued that big data is just a buzzword; elaborating that there is currently no use case for big data in the South African real estate market. R1 goes on to state that companies should not be chasing these new buzzwords like big data, but rather focus on their primary business objectives, which is to make a profit and solve their clients' current issues. R1 stated:

“I think we have to be very careful about this big data buzzword. I would say probably five commercial property businesses globally are using big data. It’s not a thing. The industry is so backward, and the volume of data is so low that there is no use case for big data” (R1).

R1 commented that the with little use of technology, such as IoT and sensors (wearable and phone devices), as well as the consumption of energy information, in South Africa. R1 views this as a general constraint, thus asserting that the country is not in a position to utilise the above technologies due to the pace of how the currently used data is collected. R5 argued that on a scale of 0 (for lack of big data and data analytics) and 10 (presence and extensive of big data and data analytics), South Africa ranks 3 as the country that witnesses the collection of relevant big data and has adequate tools to kind of analyse.

The respondents had differing views on the characteristics of the data that are prevalent in South Africa.² Though they had divergent views, all respondents did agree that there is a low velocity of data, with data being collected on a weekly or monthly basis. According to the respondents, real-time data is not collected, which forms part of the use of high-frequency data, as defined by big data.

R3 believed their organisation to be currently making use of what they understand as “big data”. His organization’s Analytics and Business Intelligence teams process the data by applying models that yield insights about past and present values.

“Our business is built on big data analytics to service industries that are concerned with property, vehicles, risk, and geolocation. The original motivation was to help lending institutions make better decisions to mitigate or reduce risk in the mortgage market. There are millions of properties and vehicles in South Africa that draw in industry makers to make decisions about them. We wanted to ensure that there is a neutral party that seeks to provide information and insights about these assets to create a fair economy for all players” (R3).

² R1 elaborated that data in South Africa has relevantly low velocity, and low volume, but high levels of variety. However, they were unsure of the difference between structured and unstructured data. This is in contrast with R4 who believed that there is a high volume of data, but low variety.

Barriers to using big data

As elsewhere, there are several barriers to the use of big data in the South African real estate market. The most glaring barrier to the use of big data is the maturity level of the South African PropTech market (Vistro et al., 2020). Respondents indicated that the market is in the very early stages and is focused on solving basic problems and until those issues are resolved, the use of advanced technologies will be hindered.

One of the barriers noted was the lack of large cloud usage. Large data sets require large storage systems such as deep storage systems, often government-based and are costly. Another challenge is the ability to capture and make sense of the data. This ability to capture and make sense of data ensures that data is not just collected and not utilized (turning it into a “data swamp”). Having all this stored data, which is not being optimally used, would increase storage costs without adding value to the company or user.

According to all the respondents, the issue of the ‘inability to capture and make sense of big data’ is linked to the barrier of scarcity of skills (Sun et al., 2013). There is a severe lack of qualified professionals with the required skills, such as machine learning and predictive analysis, in the South African market. R5 opined that beyond data scientists who offer quantitative analysis and data visualization, without the concomitant presence of business analysts who can transform that information into executable and actionable items, big data analysis's anticipated benefits are dampened. All the respondents agreed that it was becoming more difficult to attract individuals with the required skill set because of the globalisation of the labour force, where better salaries and quality of life are offered by these international cities (e.g., London and San Francisco). The acceleration of the virtual work environment, leading on from COVID-19, has compounded this issue.

Another barrier to using big data is the absence of standardisation of data protocols in storing and sharing big data in South Africa (Alharthi, et al., 2017). R4 was of the view that the use and distribution of big data need to be standardised, structured, and guided; there must be a globally recognized protocol and laws for transferring data to different entities. R3 further elaborates that there is not enough data produced in the South African real estate market to harness the promises of a concept like big data analytics. R3 was of the view that this is partially due to the frequency of data as well as the number of transactions and information available in the market. The frequency of real estate-related data is slow as the country has outdated systems as well as systems still based on physical or paper-based documentation, which has yet to be digitised, and this presents difficulty to use in the efficient and effective analysis.

Potentials of big data in the South African real estate market

Respondents were unanimous that there is potential in using big data in the South African real estate market. Several factors motivate the use of big data in a company. One of the main

motivations for companies to use big data should be to service their customer's needs better. The respondents stated that using big data and data analytics can improve the operations of a company in terms of performing more optimally, reducing inefficiencies, and increasing productivity. Using the example of a lending institution, big data can aid lending institutions in making more informed decisions, thus mitigating or reducing risks in the mortgage market. The rationale is, that by increasing the knowledge a company has of their customer, they will better understand their customers' needs, be able to predict what they may need, and then service those needs more effectively.

Most respondents agreed that several stakeholders, including government, banks, insurers, buyers, sellers, estate agents, landlords, and municipalities, would benefit from the potential use of big data and data analytics in South Africa. In this way, tracking and reporting on how the market is performing, purely from a data perspective, is very important. As millions of rands exchange hands, property ownership changes and investments are made, big data analytics becomes vital to ensure that there is a level of fairness when it comes to making informed decisions.

One respondent highlighted a potential use of big data in their company as the capability to capture any interaction that a user has on their system. The potential use of big data will allow them to capture real-time data points. Increasing the volume and the frequency of collected data, coupled with the use of predictive techniques, will enable the company to understand its customers well enough to predict their preferences and what type of product they need.

The same respondent indicated, however, that the collection and use of big data can only be enabled by evolving technology. This evolution is more likely to happen and be more accessible in developed or emerging countries. One of these vital technology evolutions includes a deep storage system that should be government-based since related costs are high. The respondent believes this evolution will take time in South Africa because there are 'bigger' issues in the country than big data technological evolutions in real estate.

However, R5 acknowledged that the route to big data and data analytics is a journey and that with the mushrooming installation of IoT devices that are now being installed in most places, it is anticipated that cleaner, organized, and indexed data will be available in the future. Such data will drive value creation in areas, such as better user experience, enabling tenants to understand their businesses better, landlords to reduce costs, and investors to run sustainable business practices.

CONCLUSIONS

With proptechs mushrooming and the use of big data and big data analytics gaining traction, this paper set out to investigate the (a) meaning, (b) the current state, (c) barriers, and (d) potentials of big data and data analytics in South African real estate sector. It thus contributes

to the body of knowledge on the potential impacts of big data and data analytics on the real estate sector in the developing world.

Respondents suggested big data is used more than a buzzword, in some instances. The sectors most influenced by big data are transactional, geospatial as well as market research data-related sectors. The potential of big data and data analytics can only be advanced by the advancements of technology as well as the growth in the market, particularly the proptech market. This coupled with a greater understanding of how the concept can be better defined there is room to unlock the great potential inherent in the real estate market in South Africa.

The potential of big data in South Africa is geared towards the applications of digitization of records, user preference information, and geographic information systems. There are other applications of big data that are not being tapped into such as project reporting, crowdsourcing, automated property appraisal, sensor information, risk identification, and property value forecasting. The largely untapped applications of big data and data analytics (given the presence of companies that are active and focusing on big data) portend endless potential around tailor-made applications in the residential, commercial, and industrial markets in the country. This is observed in anecdotal evidence, where end-users (e.g., LWP, 2024) agree that they use or see the huge potential of big data and big data analytics in designing products and services in the sectors they trade. However, this is dependent on how fast the market matures and challenges are overcome. This is also through the development of deep storage systems, increased skilled labour force, standardized data management agreements as well as the associated costs of data analytics and associated technologies.

This research recommends that companies focusing on big data in the proptech space in South Africa should consider the issue of velocity of data as this is seen as a major characteristic of the definition of big data. This will allow these companies to be more responsive, increase efficiency, and thus provide better service to their clients. One of the areas for future work is how the globalisation of the workforce affects the growth rate of adoption of big data and data analytics in the South African real estate market. This would help to unravel how the skill drain from the country is inhibiting the rate at which big data and data analytics are adopted and used locally. A paper that documents the numerous existing anecdotal evidence, as suggested above, is also equally recommended. That paper should be in the form of a systematic literature review since that way, it is possible to devote enough space to document such “evidence” than in the present exploratory paper.

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ANNEXURE A: SEMI-STRUCTURED INTERVIEW QUESTIONS

General

1. What is your title in the company?
2. How long have you been in the company?
3. How relevant is big data analytics to your job function?

Big data and big data analytics (RQ1)

4. Provide a definition of the term big data. What data attributes do you associate it with?
5. How would you define the term big data analytics?
6. What techniques and technologies are being used in your organisation or you are aware are being used in the South African real estate sector to analyse big data?

Current state of use of big data in South African real estate (RQ2)

7. If your organisation currently using big data, which sectors are big data being used in?
8. Who owns or controls big data analytics in your organisation?
9. What different types of data is your organisation currently using as big data and from where is the data being obtained? Is it structured, unstructured, or semi-structured?
10. Is your organisation using/considering using big data analytics today and how is it used? For what purpose? Is it a mature user of big data analytics?
11. What factors (internal and external) will motivate/motivate the use of big data analytics?
12. What are the main benefits for your organisation using big data?

Barriers to using big data and big data analytics (RQ3)

13. What are the challenges or barriers in using big data in the South African context? Briefly describe.
14. How does your organisation solve or intend to overcome the above challenges/barriers?

The future of big data in the South African real estate market (RQ4)

15. What is the future of big data in South Africa's real estate sector?
16. Do you have any final comments about using big data within your organisation or the South African real estate sector?

Thanks for responding to the questions.