UNIVERSITY OF NAIROBI

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE.

USE OF BIG DATA ANALYTICS IN BUSINESS AGILITY: CASE OF REAL ESTATE FIRMS IN NAIROBI.

MITCHELLE HINGA

P54/38215/2020

SUPERVISOR:

PROF. PETER W. WAGACHA

A PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE MASTERS OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT, UNIVERSITY OF NAIROBI.

JUNE, 2022

DECLARATION

This research project is my original work and has not been presented to any other university for the award of a degree.

Signed_____ Date_____08/08/2022_____

Mitchelle Hinga

P54/38215/2020

This research project has been submitted for examination towards fulfilment for the award of Master of Science in Information Technology Management with my approval as the university supervisor.

Signed_____ Date_____15/08/2022_____

Prof. Peter W. Wagacha

Faculty of Science and Technology, Department of Computer Science.

University of Nairobi.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Prof. Peter W. Wagacha for the guidance, invaluable insights, and support throughout the research process. This milestone would not have been achieved without his thoughtful insights and feedback, as well as consistently pushing me to give my best.

I am also grateful to the Department of Computing and Informatics fraternity at the University of Nairobi for support while conducting this research.

I would also like to express my heartfelt gratitude to my mother for the never-ending support and prayers throughout this research process, lecturers, classmates, and my dear friends Eve Wahome and 'Furiously' who have given me support and encouragement through this research process. Above all, I thank the Almighty God for guiding me throughout my academic life and the opportunity to reach this far.

ABSTRACT

The effect of the coronavirus pandemic has prompted firms to develop resilience to crises and the resulting shocks. As markets experience sudden changes, meeting requirements and expectations of several stakeholders requires quicker process improvements; business agility becomes a fundamental factor, one of the most decisive in turbulent environments for organizations to succeed. This study aims to look at the real estate firms in Nairobi that forms part of the social strategic sectors. Data has long been at the heart of the real estate business and although big data is not a new concept in real estate, its exponential expansion is. Technology and more so big data analytics has been viewed as a catalyst in influencing business agility in order to stay competitive in the industry. The outcomes of using big data for strategic advantage such as business agility have been varied thus far, therefore; the general objective of this study was to evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi. This research utilized the literature review method to investigate the use of technology and data specifically BDA in business agility and to review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi by operationalizing the dynamic capability theory into a workable framework focusing on an enterprise's ability to rapidly reconfigure and orchestrate competences that have been sourced externally, that will enable adaptation in fast changing business environments. Using the convenience sampling method, the target population was six real estate firms in the Nairobi metropolitan area with a sample of 40 respondents. The response rate was 90% from 36 respondents. As such, this study employed descriptive research design where both qualitative and quantitative data were gathered. Specifically, data collection was accomplished through online questionnaire method with both open-ended questions and Likert scale questions. Additionally, data analysis was accomplished through a descriptive statistical tool, and specifically SPSS and Excel. Furthermore, the mean, tabulations, percentages, charts, and tables were employed to present the findings. Finally, address the key objective of this research paper the correlation and regression model were applied. The results of the study concluded that there is a positive relationship between big data and business agility according to literature and there is a positive influence in the use of big data analytics on sensing, seizing and transforming capabilities which are business agility variables.

Contents

TABLE OF FIGURES

TABLES

ABBREVIATIONS

AHP	Analytic Hierarchy Process
BDA	Big Data Analytics
CAMT	Comprehensive Agility Measurement Tool
CEO	Chief Executive Officer
COVID-19	Coronavirus Disease 2019
CSV	Comma-Separated Values
GDP	Gross Domestic Product
IATA	International Air Transport Association
IBM	International Business Machines Corporation
ICT	Information and Communications Technology
IT	Information Technology
KBV	Knowledge-Based View
MNC	Multinational Corporations
R&D	Research and Development
RBV	Resource Based View
REIT	Real Estate Investment Trust
ROI	Return on Investment
SME	Small and Medium-Sized Enterprises
SPSS	Statistical Package for Social Sciences
US	United States
VR	Virtual Reality

DEFINITION OF KEY TERMS

Big Data- high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision-making, and process automation.

Big Data Analytics- where advanced analytic techniques operate on big data.

Business Agility- ability to answer quickly to internal and external changes, either reactively or proactively, in an efficient and effective way**.**

Real Estate- is a class of "real property" that includes land and anything permanently attached to it, whether natural or man-made.

Real Estate Firms- Organizations or companies that undertake various combination of real estate roles such as development, sales and marketing, brokerage, property management, lending and professional services.

1 INTRODUCTION

1.1 Overview

This chapter introduces the background information on big data analytics, the use, influence and what it has managed to do to the business sector in terms of business agility. The section also provides information on the problem statement, research objectives, scope of the study, significance of the study and the limitations expected in the study.

1.2 Background of the study

Enterprise agility was formerly desired but is now required. Agility throughout a whole company combines speed and stability, aids in clarity of roles, creativity, and operational discipline, and can result in excellent organizational health and performance outcomes (Aghina et al., 2020). In research from Couto (2015), Business agility is the ability to answer quickly to internal and external changes, either reactively or proactively, in an efficient and effective way. Aghina et al. (2020) affirms that despite the fact that CEOs acknowledge the benefits of agility, many considering an enterprise-wide agile transformation are skeptical of both the project's capabilities and the goals they should pursue.

Agility, or a company's ability to swiftly identify and respond to opportunities and difficulties, is viewed as a crucial firm dynamic characteristic in today's business environment. Agility is a higher-order dynamic capability that businesses achieve by designing appropriate work processes and taking use of lower-order dynamic capabilities like the use of information technology to improve, align, and reconfigure their standard capabilities.

However, according to a Hayward (2021) article, there are a number of obstacles to corporate agility. The most fundamental obstacle to agility is a risk-averse culture, which is one of the hindrances. A cautious mindset might impede development. In tightly regulated businesses, where compliance might lower managers' risk appetite, this can be a particular problem. Since many big companies are burdened with the legacy of extensive bureaucracy and are frequently motivated by a need to minimize risk, management may also be a significant impediment to business agility. Organizations become unresponsive and uncompetitive as a result of bureaucracy's slowing down of decision-making and execution.

Silo working can also make it more difficult to achieve corporate agility. The new standard for individuals driving innovation in our digital age is working collaboratively across teams, functions, and organizations. However, many find it difficult to overcome the boundaries that exist across

various roles, places, and demographic groupings. Finally, one of the biggest obstacles to agility is a lack of client proximity. Customers often anticipate a smooth experience when dealing with various departments within a business, but internal roadblocks and strained departmental relationships can make this impossible. Staying in constant contact with the client is a core tenet of agile functioning. To guarantee that there is a shared knowledge of consumer demands, it is crucial to put the client at the center of your business (Hayward, 2021).

According to literature, Business agility enablers are categorized as Human capabilities, Network characteristics, IT capabilities, organization culture and governance, and Organizational architecture (BlinkLane Consulting, 2016). Therefore, the usage of information technology (IT) is one of the most important ways for businesses to improve their agility. For example, data analytics technologies may assist businesses in detecting market shifts and, as a result, enhance their response speed and efficacy; in other words, boost their agility. Only 25% of organizations claimed that using analytics has "substantially" enhanced their organization's outcomes in a Deloitte research (Deloitte, 2013). As a result, it is worth pondering what makes certain data analytics investments more productive than others, and in different sectors of the economy. The main objective of this study is to examine the impact of data analytics use on fostering organizational agility in light of the surge in its use and the variety of consequences it has produced. We use Dynamic Capacity Theory (DCT) to examine how data analytics, a lower order dynamic capability, affects business agility in order to achieve this (a higher-order dynamic capability). This is consistent with the widely-held notion that IT talents are lower-order dynamic abilities that enable the development of higher-order dynamic abilities like agility (Ghasemaghaei et al., 2017). According to the strategic management literature, in turbulent business settings where the sector is changing fast and competition is increasing, businesses must become more agile in recognizing and responding to freshly appearing opportunities in order to be successful (Hassna & Lowry, 2016).

Market disruptors come in a variety of shapes and sizes, and any one of them might force a business to adapt fast to shifting market conditions. The Global Hazards Report from the World Economic Forum looks at the problems associated with societal fissures, including chronic and rising health risks, rising unemployment, widening digital divides, young dissatisfaction, and geopolitical dissolution. Businesses run the danger of a disruptive shakeout that might exclude important demographic groups and companies from upcoming marketplaces. Environmental degradation,

which still poses an existential danger to humanity, has the potential to collide with societal flaws and have catastrophic effects. The threat of a pandemic became a reality in 2020. The importance of community cohesiveness is more crucial than ever as governments, corporations, and communities cope with COVID-19 (The Global Risks Report 2021, 2021).The effect of the coronavirus has prompted firms to develop resilience to crises and the resulting shocks (Al-Omoush et al., 2020).

In 2019, the tourism and hospitality sector contributed around 8.8% of Kenya's GDP and 1.1 million jobs to the country's economy, according to a Deloitte report (2020). Due to travel limitations that had completely stopped international tourist arrivals as a result of the COVID-19 epidemic, as well as social segregation regulations that have hurt domestic tourism and conferencing, both global and local leisure and conference tourism were at risk of failing. Together, Kenya's real estate and construction industries provide 12.4% of the nation's GDP (Deloitte, 2020). The main disruptions in these businesses are shorter work hours, a decline in building materials as a result of supply interruptions, and a decline in housing demand. The structural shift from physical to virtual in many activities, or relocations outside of large cities, have a negative impact on the retail and office sectors. Rents have decreased by 10.3 percent in comparison to 2.8 percent in 2019, and businesses have frozen expansion as the pandemic has progressed, which has decreased demand for office space. Overall, this resulted in a large number of vacant homes, decreased rentals, lower home values, and building activities that were impacted by supply chain disruptions, which prolonged development times due to longer lead times in getting supplies, delaying the completion of projects (KENYA FINANCIAL STABILITY REPORT, 2020). As the government gathers finances to combat the pandemic and respond to emergency actions, the public housing project will be harmed. Further consequences for the construction and real estate sectors include a drop in project funding, as lenders are hesitant to finance construction projects due to the unpredictability surrounding project completion.

Despite the COVID pandemic’s effects on businesses across the globe and in Kenya, some of the businesses appear to be surviving the storm better than others. According to Veseling (2021), when everyone else was waiting to see how long the epidemic would endure, Standard Group took a strategic decision to invest. By turning their newsroom into a wholly digital-first organization, the leadership accelerated their digital business transformation. They were zealous in their use of data to better analyze and categorize their target audiences, user behaviors, and pricing sensitivity. In

the technology age, business agility has become more important for businesses to thrive and compete (Felipe et al., 2016; Lu and Ramamurthy, 2011). Modern technology, such as cloud computing and big data analytics, is meant to help businesses stay competitive by allowing them to respond quickly to changing market conditions, execute strategies efficiently, and generate lucrative business results (Liu et al., 2018).

Big data analytics has been described in the literature as a capacity that leads to improved performance and relies on the coordination of strategic resources (Akter et al. 2016; Wang et al. 2016; Wamba et al. 2017). Big Data, according to Gartner, is defined as high-volume, high-velocity, and/or high-variety information assets that necessitate innovative kinds of processing to allow better decision-making, insight discovery, and process optimization. The goal of a strategic Big Data approach is to derive corporate value from constantly changing data. For this study we were particularly interested in the influence of use data analytics, which is becoming an increasingly important corporate IT skill, on business agility. The level and frequency with which such technologies and data sources are used is referred to as data analytics utilization. In many firms, data analytics has become a must-have resource; it is a vital resource in today's competitive market. BDA's significance arises from its capacity to assist businesses in making better, more informed, and frequently faster choices (i.e. be more agile). These advantages accrue because companies that employ data analytics correctly are able to detect and respond to market changes quickly and effectively.

1.3 Problem statement

The Real estate sector in Kenya has experienced disruption due to the covid-19 pandemic (Kenya Overview, 2021). Longer development times are anticipated as a result of lower finance, a decline in the labor force and supply chain disruptions brought by the pandemic's overall risk aversion (Impact of COVID-19 on Kenya's Real Estate Sector, 2020). Pandemic crises and their global effects have been characterized as an unanticipated event that has had a negative influence on real estate project development, ongoing real estate sales activities, cost projections, valuations, and return rates in the existing real estate sector generally. There is a need for real estate firms to be agile so as to respond to this pandemic and other market disruptions. There is little evidence in literature on how real estate sector in Kenya has been able to sense, seize and transform their businesses in the current market disruptive environment using BDA. This study sought to

investigate the relationship between big data analytics and business agility in literature and analyze the influence of use of big data analytics in business agility in the real estate firms in Nairobi.

1.4 Justification

Technology and more so big data analytics has been viewed as a catalyst in influencing business agility in order to stay competitive in the industry (Battisti et al., 2019; Gunasekaran et al., 2017). The outcomes of using big data for strategic advantage have been varied thus far. Some businesses have successfully transformed their operations; others have only achieved gradual progress; and still others have not begun (Ross, Beath, & Quaadgras, 2013). Research done on big data has mainly focused on the financial sector and the capabilities and benefits it brings to the sector. Mbaluka (2013) and Mugane (2019) researched on commercial banks and Fintech organizations in Kenya thus offering recommendations to further research in other sectors to establish the extent of use of big data analytics on other sectors.

1.5 Objectives

According to research by DeLisle et al., (2019), data has long been at the heart of the real estate business and although big data is not a new concept in real estate, its exponential expansion is. Real estate firms may increase their value by using the data they already have and produce, but this is not occurring on a broad scale owing maybe to a lack of understanding (Winson-Geideman et al., 2016). Therefore, the general objective of this study was to evaluate the influence of use of big data analytics on business agility in the Real estate firms in Nairobi and specifically:

1. To investigate the use of technology and data specifically BDA in business agility.
2. To review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi.
3. To evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi.

1.6 Significance of the study

Real estate firms will be able to appreciate the importance of data and data analytics, while improving its agility by making informed decisions. The study will serve as a foundation for future academic studies into the domain of big data analytics in the Kenyan real estate sector by academics and researchers. The study will also give more background information to research groups and scholars interested in conducting additional research in this area. Academicians will profit from the study's findings since they will add to the current body of knowledge in the area of

big data and its use in a third world country such as Kenya. Based on what the organization has gathered to be helpful, the general public or clients serviced by businesses that use big data analytics are likely to gain from better service delivery, efficiency, and innovation.

1.7 Assumptions and Limitations

The research is confined to real estate firms in Nairobi, Kenya, that are thought to be important players in the Kenyan real estate market. It is believed that the companies picked will be willing to share information for research purposes. It is also believed that real estate businesses have a similar organizational structure that contributes significantly to the firms' business agility, and that the data gathered and processed is utilized to assess the extent to which big data analytics impacts the firms' business agility. The effects of covid-19, which have had an impact on the impair normality and work capacity, are one of the study's limitations; as a result, online questionnaires were sent to the recipients and persistent data collecting follow-up methods will be used such as constant reminders.

2 LITERATURE REVIEW

2.1 Introduction

This section provides literature reviews on the relationship between big data analytics and business agility. It also provides a review of the literature pertaining to the dynamic capabilities theory as well as business agility and data analytics use. It also includes empirical literature based on what has been done in Kenya and throughout the world in reference to big data analytics and business agility.

2.2 Theoretical review

The selected theories employed by this study are Resource based theory and the Dynamic capabilities theory. The two theories fit in explaining how the use of big data analytics can be banked on to maximize business agility through achievement of sustained competitive advantage, fusing of the strategic relations existent between IT and business and operationalization of the dynamic capabilities to develop a model for evaluating agility in the real estate firms in Kenya.

2.2.1 Resource-based view

Resource Based view (RBV) is a managerial model that enables a firm to possess competitive advantage by focusing on how its available resources can be exploited sustainably (Wang, 2014). Avishikta (2021) postulates that the theory specializes in assessing firms from an 'inside-out' perspective, analysing practical and managerial reasons as to why companies succeed and/or fail to function within a given market niche. The theory has been used to methodologically direct activities of most real estate firms on sustainable use and development of internal/external resources to create sustainable competitive advantage (Madhani, 2014). In the world of data analytics and business agility, real estate firms can contextualize RBV so that they can use their resources effectively to gain more market dominance, capitalizing on resources such a working employee pool, technological savviness, and structured capital capabilities.

To continue, RBV focuses more on the internal factors that enable a conducive environment for firms to realise their competitive advantage within specific market. Madhani (2014) asserts that the theory is useful also in establishing the fact that for superior competitive advantage, firms are supposed to develop its internal resources with an aim of increasing their capacity to operate in external business environments. Liu, Chan, Yang, and Niu (2018) articulate that such resources that are existent within an internal capacity comprise such elements as employee capabilities, business agility strategies, capital for production/manufacturing, service-provision resources, data analytic tools, among others. Such internal capabilities are imperative when formulating decisions

and choices that have consequent effect on external factors, determining the extent to which firms can adjust their operationalization processes to compete within a specific market spectrum (Wang, 2014; Ullah et al., 2017). Moreover, internal sources such as superior data analytic tools are a source of increasing customer value. The resource-based theory was applied in this study to analyze the data sources and build on the dynamic capabilities theory to evaluate and analyze the influence of use of big data analytics in business agility variables in real estate firms in Nairobi.

2.2.2 Dynamic Capabilities Theory

The dynamic capability theory emphasizes on the need to reconfigure, build, and integrate both external and internal capabilities to address the fast changing business environment for the growth of any firm. The theory affirms that for a business to be successfully operational, it is imperative for it to adapt purposefully to its resource base. The theory was developed by hypothesizing RBV further (Lin & Wu, 2014). Advancing from the RBV theory, the dynamic capability theory focuses on competitive survival in the face of rapidly changing business environment and/or external contemporary conditions surrounding an enterprise (Pisano, 2016). For instance, within big data analytics, digital networks can be described as channels that enable businesses to adapt easily within changing technological environment with fast speed capabilities (Wheeler, 2002). Such speed among digital networks enables the firm to execute and recreate innovative solutions with fast agility, assisting in sustenance of competitive advantage.

The dynamic capability theory developed from the RBV theory. Furthermore, a newly rationalized dynamic capability theory when operationalized into a workable framework focuses on an enterprise's ability to rapidly reconfigure and orchestrate competences that have been sourced externally, navigating from IBM Linux, Google Android, and Apple developer ecosystems to crowdfunded and crowdsourced open innovative spaces (Shuen, 2008). Such new dynamic capabilities can be useful in real estate sectors for conceptualizing ideas quickly (Gitau, 2015). Winson-Geideman and Krause (2016) opine that dynamic capabilities for real estate firms is more resourceful in complementing real estate businesses as it factors in both internal and external resources that will enable adaptation in fast changing business environments. Giniuniene and Jurksiene (2015) assert that big data analytics such as reliable digital networks and net-enabled IT resources enable businesses' agility to be fast, efficient, and effective. Such 'dynamic' capability can easily operationalize big data analytic tools in the real estate industry to work easier on large volumes of data for optimal and efficient processing.

The composition of dynamic capability		
(1) sensing capability	**(2) seizing capability**	**(3) reconfiguring capability**
Firms need to explore their internal and external environment in order to identify opportunities.	**As soon as opportunities are sensed, they must be addressed through new products, services, processes, etc.**	**To address new opportunities, firms need to recombine and reconfigure resources and capabilities as environmental changes.**
Common practices/activities are: • identifying new technologies, • identifying new ideas, • scanning for new markets/ customers.	Common practices/activities are: • activities to select the "right" new technology or a business model, • activities to build commitment and loyalty.	Common practices/activities are: • activities to stimulate open innovation, • activities to managing strategic fit, • deploying knowledge management.

Source: Adapted from Teece (2009).

Table 1: Types of Dynamic Capabilities, Their Nature, and the Related Key Firm's Activities. (Adapted from Teecee) (2009)

The dynamic capacity hypothesis was used in study by Drydakis (2022) to look at the relationship between AI in SMEs and decreased business risks brought on by the COVID-19 pandemic (Teece, 2007). A comprehensive framework for evaluating the benefits of SMEs' digital transformation is provided by the dynamic capabilities theory (Warner & Wäger, 2019). SMEs' engagement with the movement toward digitization and cutting-edge technology depends on how much AI they are using (Warner & Wäger, 2019). Information systems researchers who study AI, dynamic capabilities, and SMEs performance may be interested in theoretical insights into how the use of AI applications could improve dynamic capabilities and boost SMEs performance during the COVID-19 pandemic given the growing adoption of AI in entrepreneurship (Hansen & Bgh, 2021; Ulas, 2019) and the effects of the COVID-19 pandemic (OECD, 2020). Dynamic capabilities differ from substantive capabilities (such as operational processes) in that they explain how businesses restructure and integrate their resources to adapt to changes in the environment. As a result, dynamic capabilities assist businesses in detecting and responding to opportunities and risks. Since it embodies these qualities and is used to develop and alter other capacities, agility is a dynamic capacity. Therefore, this study adopts a similar approach in utilizing the dynamic capabilities theory in developing a model for evaluating agility in real estate firms in Nairobi and also

analyzing the influence of use of big data analytics in business agility (sensing, seizing and reconfiguring capabilities) in the real estate firms in Nairobi. In the context of this research, DCT provides a framework for examining whether company IT skills (in our example, data analytics utilization) may be used to boost a business's agility. Because of the increasing usage of data analytics and the varied results it has created, this research focuses on it as an example of IT skills. DCT is an acceptable lens for understanding the influence of data analytics utilization in organizations, according to Chen et al.

2.3 Empirical review

2.3.1 Fundamentals of Big data

One of the most valuable corporate assets is data. Being a learning company requires sourcing, storing, sharing, safeguarding, analyzing, and presenting data insights. Big Data is fundamentally data, with vast volumes, high velocity, and a wide range of variation laced with authenticity. These are the most well-known Big Data Vs. "Large pools of data that can be acquired, transmitted, aggregated, stored, and evaluated" is how McKinsey defines Big Data. The goal of a strategic Big Data approach is to derive corporate value from constantly changing data. According to Botelho and Bigelow (2021), big data is made up of six dimensions as shown in Figure 1.

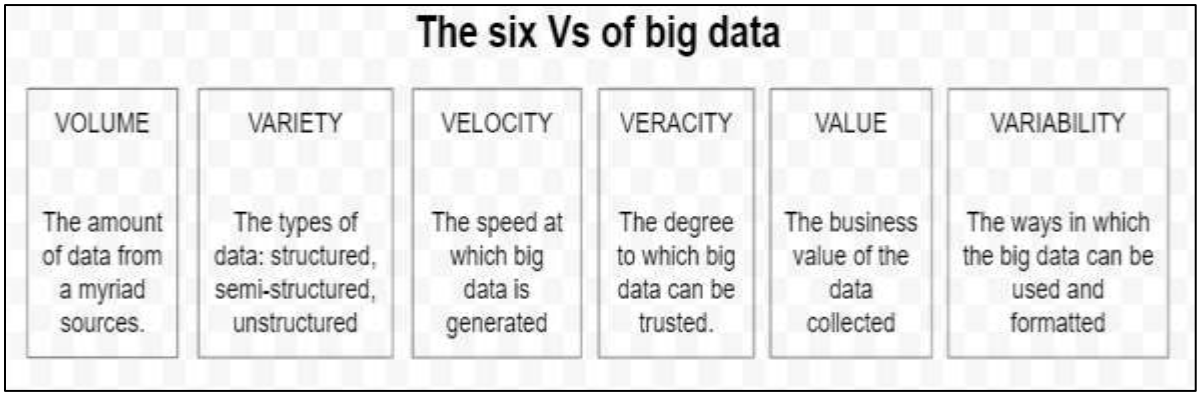

*Figure 1***:** *Dimensions of Big Data (TechTarget, 2022)*

Data is fundamentally factual and static. It has no bias or value because it is atomic in nature. It is simply a record of an observation. When a collection of data is combined, chances for connections or linkages emerge. The data itself, as well as the intricacy of its processing, are uninteresting to business. Extracting value from data is something that businesses are very interested in. These connections between a large number of data pieces (data) conceal some fascinating patterns and trends. The process of unraveling patterns and trends is known as analysis. The technique of

uncovering hidden value within these patterns and trends is also known as analysis. This benefit is gained through improved decision-making agility.

The disciplines of information technology (IT) and information science seek to give this value by first understanding the business's needs and intended outcomes, and then developing solutions to meet those goals. Furthermore, this information is presented in a variety of formats, including text, pictures, audio, and video. Because of the properties of Big Data, firms must rethink their organizational structures, business processes, and enterprise architecture.

2.3.2 Adoption of Big Data Analytics

2.3.2.1 Health Sector

The area of health and human wellbeing is one of the most attractive uses of big-data analytics. Pharmaceutical data, data on personal behaviors and preferences (including food habits, exercise routines, and environmental variables), and financial/activity records are all examples of healthcare data. The key to major gains in treatments, delivery, and well-being is effectively integrating all of this data (Dash, 2019). Big-data analytics' cost-benefits in the healthcare sector are also well-known. While imaging data presently dominates healthcare data volumes, it is possible that customized genomics and high-throughput screens may have an impact on data analysis in the near future (Dash, 2019). A number of analytical activities are likewise time-sensitive. Patient diagnoses, outbreak progression, and other tasks, for example, all have stringent performance criteria. In healthcare informatics, data quality, privacy and security, and the efficacy of analysis are all significant concerns. The management of clinical data must be restricted not only by established laws and procedures, but also by the privacy expectations of the subjects. Pharmaceutical data is highly prized intellectual property, and its usage is strictly controlled.

2.3.2.2 Supply Chain

Business companies have perhaps been the most apparent use of big-data analytics. According to estimates, a merchant who fully utilizes the potential of analytics may boost their operating profit by 60% (McKinsey&Company, 2015). Utilizing fresh possibilities (such location-aware and location-based services, for instance) might lead to significant income development. A complete analytics platform would need to include supply chain management, customer management, after-sales support, advertising, and other activities. Businesses collect a variety of multi-modal data, some of which include customer transactions, inventory management, store-based video feeds, advertising and consumer interactions, customer preferences and moods, sales management

infrastructure, and financial information. The datasets used in these apps are organized and integrated.

2.3.2.3 Real Estate

Data has long been at the heart of the real estate business, academic field, and asset class - lease and vacancy rates, house price indexes, lot sizes, interest rates, REIT returns, and so on (DeLisle et al., 2019). Although Big Data is not a new concept in real estate, its exponential expansion is. Real estate organizations acquire a lot of data that is stored in silos with no analytics performed to identify industry trends or consumer habits thus resulting to smart decision making. Real estate has gained respect on a global scale for playing a crucial part in social, political, and economic growth (DeLisle et al., 2019). It is crucial for creating employment opportunities, improving income distribution, and reducing poverty globally.

On the academic front, Big Data has mostly been used to anticipate house values using online searches and media opinion. The possibility of Big Data in forecasting future movement in residential real estate markets has been emphasized in China by employing search keywords and media output (Sun, Du, Xu, Zuo, Zhang & Zhou, 2014). Big Data computing methods such as Machine Learning (Mu et al. 2014). Wu and Brynjolfsson (2015) used Google search trends in the United States to develop a model that outperformed the National Association of Realtors' house price estimates by more than 20%. Wu and Deng (2015) conducted more research on the Chinese market, demonstrating how knowledge and interest in various sectors flows from China's major cities of Beijing, Shanghai, and Shenzen down to minor and tertiary regions. Xinfeng, CICC, Haowu, and other real estate and property firms in China were highlighted by Du et al. (2014) as examples of businesses that have successfully used big data to address stakeholder needs related to property information, buyer demand, transaction data, page view, buyer personal information, and historical transaction information.

2.4 Real Estate in Kenya

The term "real estate," often referred to as "real property," refers to land as well as any other physical improvement that may be erected on it or incorporated into it. An example of an improvement would be a building or a road (Amadeo & Uradu, 2021). Undeveloped land, houses, townhomes, offices, buildings, retail stores, and industries are a few examples of real estate. The land and improvements, their selling and renting prices, the economic rent of the land, returns on buildings and other improvements, and the construction industry are all covered by the real estate

market (Nzalu, 2013). Residential, commercial, industrial, and land are the four categories of real estate, each having a specific use and utility, as noted by Amadeo and Uradu (2021) and Corporate Finance Institute (2020), and they are depicted in Figure 3 below. However, the real estate sector may be separated into a number of distinct segments, including development, sales and marketing, brokerage, property management, lending, and professional services like law and accountancy (Corporate Finance Institute, 2020).

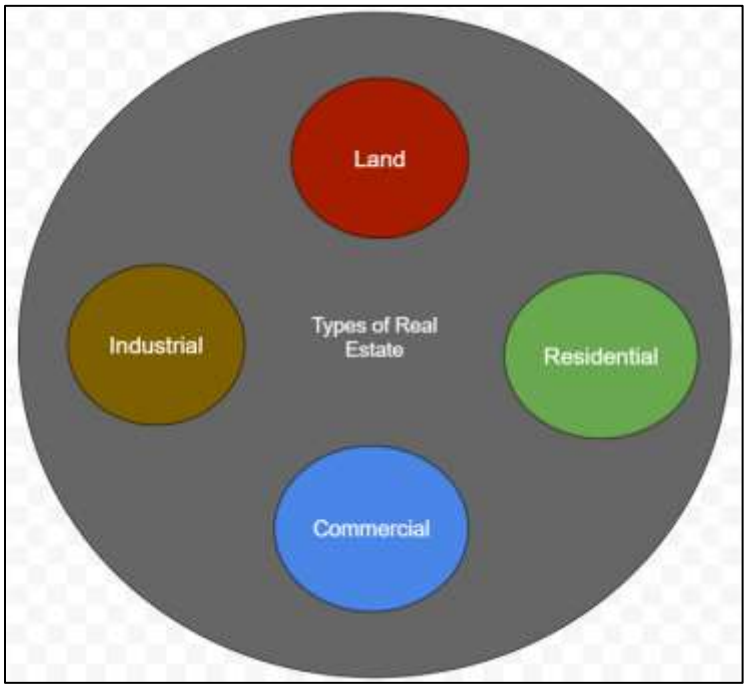

*Figure 2***:** *Types of Real Estate (corporate finance institute)*

A research by Research and Markets (2020) states that in 2019, the real estate industry in Kenya generated almost 7% of the country's GDP. There were 434 licensed estate agents in March 2020, the same number as in 2019, and an estimated 40,000 unlicensed agents. With a small number of international companies doing business in the nation, the majority of players are privately held real estate agents and developers. Access to affordable housing poses a significant barrier to the expansion of the housing and mortgage markets. Because of this, just roughly 20% of Kenyans who reside in metropolitan areas own their homes (Research and Markets, 2020).

2.5 Real Estate and Big Data Analytics

As much as the real estate sector in Kenya continues to experience growth, it also continues to confront problems like as an unfavorable interest rate environment and high population expansion,

both of which are driving up housing demand as families grow and consumer requirements shift to reflect independent living (Muiruri, 2018). The real estate industry is currently facing a number of challenges, including a scarcity of skilled labor, rising project costs, longer construction times, a lack of proper record-keeping strategies, competition, data loss, duplication, slow access to information, and the use of antiquated methods of data analysis and storage (Gitau, 2014). Private property brokers and realtors can provide more up-to-date information, however this information is not always consistent, and the information's trustworthiness and impartiality may be questioned because there is no centralized public listing of commercial property (Institute of Economic affairs et al., 2011). Due to the difficulties of acquiring housing market data, real estate research has been limited (Wang, 2014).

In the United States for example, the news channels have been flooded with reports concerning moves that are directly influencing the US economy and real estate investments during the last several months e.g. the covid-19 pandemic (Dokovic, 2019). The real estate business has become a poster child for anxiety and apprehension. With tremendous change in commercial real estate circles, well-informed property managers must learn to adapt quickly or risk being left behind (Dokovic, 2019). Companies will need the ability to design new strategies and implement new business models fast in order to become genuinely agile real estate organizations. That involves having an agile mindset and having the proper technology, data sources and technical tools to complete a task (Puckett, 2021).

The introduction of technology presents numerous problems to real estate market participants, as well as new possibilities to increase innovation, product development, and customer service. The ability of real estate players to adopt advanced technology and smoothly incorporate them into their business processes would be critical to driving development in such a situation (Gitau, 2014). According to a research conducted by the National Association of Realtors in the United States in 2021, 97 percent of property purchasers utilized the internet to search for homes, and 51 percent discovered the home they bought online. Today, looking for a property to purchase or rent is an internet process involving applications, websites, and online forums (Quick Real Estate Statistics, 2020). Real estate service providers who focus on providing customized, customer-centric property solutions may improve customer satisfaction. Furthermore, data insights may be leveraged to assist buyers and sellers in meeting their needs. As a result, service providers may present themselves as prospective clients' preferred real estate partners (Jara, 2022). With data

analysis, it is now possible to make more precise forecasts regarding risk and market patterns. Risk mitigation, simple and quick assessments, a better knowledge of customers' demands, enhanced marketing tactics, market trend forecasts, and home insurance businesses may analyze data from many sources to design and customise insurance offers for consumers and geographic regions (Jara, 2022; Bright Data LTD, 2022).

An article by Marangu (2021) affirms that big data may enable better administration and control of various real estate systems, resulting in greater interoperability. The Marangu (2021) article further outlines that for urban planners, streamlined data and resource exchange improve information openness. This collaboration and communication across organizations could improve operations, improve customer service, generate tailored marketing campaigns based on unique consumer preferences, and, as a result, increase profitability. Businesses who use big data have a chance to gain a long-term competitive edge (Marangu, 2021).

Data automation can greatly simplify key company tasks such as selling properties, obtaining qualified leads for properties, managing projects and portfolios, and asset management. Real estate organizations are using technology like big data to strengthen their competitive position due to improved service delivery, communications, speed to market, and new growth potential (Battisti et al., 2019). For instance, in the real estate sector, it will be possible to more thoroughly assess the customer experience and automate both internal and external actions based on the data. Big data analytics provide real-time resource monitoring capabilities in real estate development, allowing for the evaluation of resource use while pinpointing waste areas and better distributing resources while limiting costs and lowering energy and natural resource consumption (Marangu, 2021). Big data analytics may also be utilized to investigate the influence of various forms of development and tenant mix on commerce and people flow.

For this study we focused on real estate organizations that are within the Nairobi area which is the capital of Kenya and have a revenue of more than $10M according to the real estate zoominfo database in literature (ZoomInfo, 2021).

2.6 Business Agility

Business agility has grown more crucial in the era of technology for organizations to survive and compete (Felipe et al., 2016; Lu and Ramamurthy, 2011). Cloud computing and big data analytics are examples of modern technology that may help organizations stay competitive by allowing them to adapt rapidly to changing market conditions, execute initiatives efficiently, and produce

profitable business results (Liu et al., 2018). Business agility, according to Couto (2015), is the capacity to respond swiftly to internal and external changes, either reactively or proactively, in a cost-effective and efficient manner.

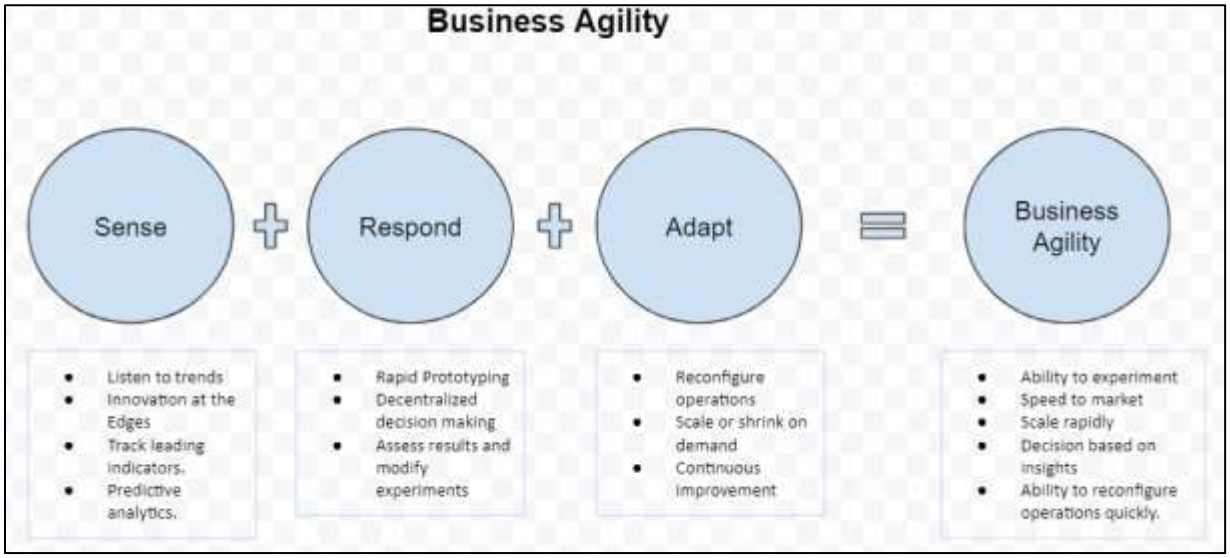

*Figure 3***:** *Business Agility (Slideshare, 2017)*

While intangibles such as leadership have long been used to assess company agility, technology has been overlooked. However, 70 percent of Fortune 1000 firms that existed just ten years ago have already disappeared, unable to adapt to change (Forrester, 2021). As a result, in today's business ecosystem, a combination of agility across several dimensions is required to be effective.

2.6.1 Means for Business Agility

The tools that allow a company to improve its business agility are frequently referred to as the business agility means. These five areas are the business agility enablers for enterprises, supply chains, and even business networks, according to the literature. The list of enablers does give a picture of the topic's broader extent and the amount of attention it has received in the literature (Oosterhout, 2010). The first domain is network human capabilities. Employees' abilities and expertise are equally vital when it comes to business agility. Employees must be able to deal with change and be adaptable enough to deal with the unexpected. This is also known as workforce flexibility (Breu et al., 2002). Network characteristics refer to the fact that organizations no longer function in isolation; instead, they cooperate with suppliers, consumers, and other stakeholders as part of a larger network. If a company's suppliers are unable to adapt, it will be unable to respond to unanticipated developments. IT capabilities refers to emerging technologies and technical

infrastructure that enable business agility. Organization Culture and governance means that being an agile company necessitates not just agile processes and technologies, but also an agile mindset and culture. An organization's leadership has a significant impact on an employee's ability to embrace change. This encourages flexibility Rewards, empowerment, and performance measurements are the most essential ways for managers to affect company agility. Finally, Business processes and operating system architecture make up the Organizational Architecture. The gained insight has been presented to encourage businesses to identify their marketing and technology skills in the context of big data analytics, as well as any gaps or areas of ignorance, and to take appropriate action to close such gaps or regions of ignorance. Strong big data analytics capabilities have been proven to put businesses in a better position to spot new market opportunities and threats and respond successfully through rejuvenated marketing techniques. The insights provided by strong big data analytics abilities can be used to meet requirements that are more particular. By combining data from various sources and aiding in the better identification of noncustomer groups, sentiment sensing and social media monitoring, for instance, enable a better understanding of consumer behavior, interactions, and experiences with a product or service, as well as more detailed and real-time customer segmentation.

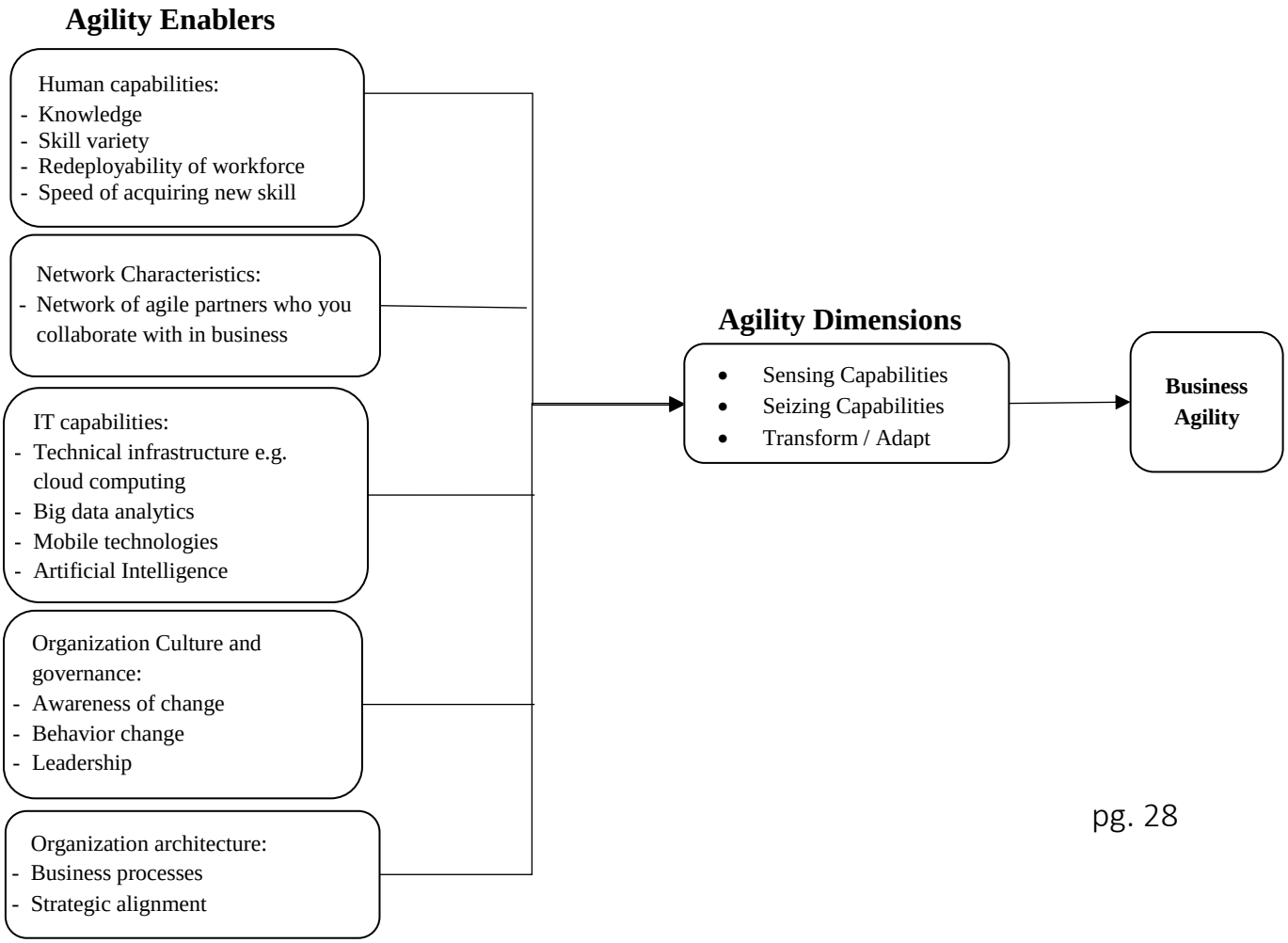

Figure 4: Means for Business Agility (Oosterhout, 2010 , BlinkLane Consulting, 2016).

2.6.2 Business Agility and Big Data Analytics

The amount of granularity used in decision-making is a key distinction for Big Data as compared to conventional data. Big Data technologies enable corresponding analytics to dig down to the most detailed level of action. In the age of high-velocity data, Big Data's capabilities is extremely valuable. Changes in the incoming data must be incorporated in decision-making as soon as possible. Big Data is also a disruptive technology. Big Data has the potential to drastically alter the corporate landscape. Change is not merely a part of a business; it is at the heart of it, as evidenced by the business implications of covid-19.

Many explicit analytics-based considerations are layered on the decision makers' implicit experiences in business choices. To mention a few, good business decisions include components such as trust, cross-functionality, teamwork, iteration, intuition, bravery, and visibility. These are the characteristics of an agile organization. This brings up the possibility of using Big Data as a "Agile value" generator. Big Data presents chances for operational improvement in company operations, enhanced and timely customer service, increased risk anticipation, adherence to regulations, and environmental sensitivity. The usage of information technology (IT) is one of the most important ways for businesses to improve their agility. For example, data analytics technologies may assist businesses in detecting market shifts and, as a result, enhance their reaction time and efficacy; i.e., boost their agility.

Several pieces of literature, according to Oliveira-Dias et al. (2022), show that emerging information and digital technologies, and more specifically, a set of information and digital technologies that is widely adopted by companies, such as Cloud Computing, Big Data, AI, and IoT, impact strategies such as this (Giannakis & Louis, 2016). Big Data may aid supply chain visibility by providing end-to-end real-time information on suppliers' inventory as well as forecasting future product demand changes. Customer input on social media sites, in particular, may be used to supplement sales data and aid demand forecasting. The final observation of these findings is that deploying these developing information and digital technologies throughout the

supply chain allows for both flexibility and agility, hence it is highly recommended (Oliveira-Dias et al., 2022).

2.6.3 Big Data Analytics and Sensing capabilities

The gained insight has been presented to encourage businesses to identify their marketing and technology skills in the context of big data analytics, as well as any gaps or areas of ignorance, and to take appropriate action to close such gaps or regions of ignorance. Strong big data analytics capabilities have been proven to put businesses in a better position to spot new market opportunities and threats and respond successfully through rejuvenated marketing techniques. The insights provided by strong big data analytics abilities can be used to meet more particular requirements. By combining data from various sources and aiding in the better identification of noncustomer groups, sentiment sensing and social media monitoring, for instance, enable a better understanding of consumer behavior, interactions, and experiences with a product or service, as well as more detailed and real-time customer segmentation.

2.6.4 Big Data analytics and Seizing capabilities

A company's response to market needs is referred to as seizing in order to maximize revenue, profitability, and share of the market (Teece et al., 2016). Seizing is defined as "making more effective decisions to build enhanced processes and business models in order to gain competitive advantages" by Mendonça & Andrade (2018) and Teece (2007). By prioritizing target customers and market segments, dynamically allocating resources to meet the needs of customers, and supporting real-time process automation by converting strategic Key performance indicators into operational efficiency and effectiveness to inform decision-making and guide actions, big data analytics capabilities can help businesses seize opportunities.

2.6.5 Big data analytics and Transforming capabilities

Furthermore, transforming entails updating and sustaining the relevance of business procedures (Teece, 2018). The DCT implies that transforming is critical to achieving long-term success (Zahra et al., 2006), and that SMEs must endeavor to simplify, adapt, and enhance organizational operations on a proactive basis (Teece et al., 2016). Emerging technologies can help SMEs transition by allowing them to embrace and create new technology and operational processes. Strong big data analytics skills result in a greater capacity to alter marketing tactics, redefining how marketing is carried out, clients are discovered and contacted, and the extent to which products and services are tailored to meet their demands.

2.6.6 Evaluating Business Agility

According to literature, business agility can be evaluated using different methods. The first factor to how to measure or quantify business agility is the success rate of any business after responding to internal and external changes. According to Horn (2020), corporate and business success rates can be measured using different methods, all dependent on whether the response to changes was performed in a cost-effective, strategic, and efficient manner. Business agility metrics are also quantifiable through the amount of profits that a company makes after re-strategizing its operationalization methods due to external or internal changes (Liu et al. 2018). In the event that the profits making continues, the capability of such a business to being agile is affirmed.

The second factor on how to evaluate business agility was through the already established tools in literature. Though various methods for measuring agility have been established, they are mostly focused on the manufacturing business. Because agility is prevalent in many industries, a comprehensive model to measure it is required to identify an enterprise's response to external turbulences (Somanath et al., 2013). Drawing from the various concepts and frameworks developed (Sherehiy et al., 2007; Yauch, 2011; Somanath et al., 2013), this study has adopted characteristics or attributes of agility that may be used to measure agility in a real estate firm in Kenya from the comprehensive agility measurement tool(CAMT) together with an operationalized Dynamic capabilities model. Despite using a mathematical model, CAMT is very subjective because the administrator chose the 10 important criteria among the 41 agility enablers Kuruppalil identified (Kuruppalil, 2018). The AHP (Analytic Hierarchy Process) approach, which includes the introduction of bias, is used in this CAMT. The statements of an AHP are flawed, and the rank established by this system rely on a person's expertise as a Decision Maker. Hence in this research we categorized the ten factors according to the operationalized dynamic capabilities theory in order to establish the business agility variable that the factor addresses and thus can assist in identifying specific areas of improvement for organizations to address in order to achieve business agility. The factors will be tested against the real estate companies in Kenya using a questionnaire to ascertain which is most likely and least likely to affect business agility with the respective organizations. The survey will target the IT administrators who will offer insight on the organization’s technology adoption, the managers who will offer insight on innovation and product diversity and also the firm’s responsiveness, the human resource analysts will offer insights on the various related attributes on employee training, attrition and profit increases. The project managers and sales and

marketing executes will also be critical in offering insights on products and services delivery quickness and timeliness.

2.6.6.1 Operationalized Dynamic capabilities theory

While significant conceptual progress has been achieved in regards to the importance of Dynamic Capabilities and how they are generated, actual research in this area is still limited (Zahra et al., 2006; Wang & Ahmed, 2007). Furthermore, the lack of accuracy in the measurements employed to assess Dynamic Capabilities makes empirical investigations difficult. The research done by Alsos. G et al, (2007) contributes to the Dynamic Capabilities debate by constructing and experimentally verifying measuring scales for empirically analyzing Dynamic Capabilities.

We draw on Alsos. G et al's (2007), Teece et al's (1997), and Eisenhardt and Martin's (2000) concepts of Dynamic Capabilities in this study. It is evident that no one dynamic capacity exists. Internal and external resource reconfigurations, learning and strategic decision-making, restructuring and post-acquisition integration processes, R&D processes, product development processes, and market response are all examples of DCs that have been attempted to categorize (Madsen, 2010). Each of the four general categories may be thought of as a set of consistent concepts represented by a single scale. The measuring scale is then fine-tuned to bring the sub-dimensions identified for three of the generic kinds together (Sense, Respond and Transform / Adapt). The four general kinds can be thought of as broad categories with several sub-dimensions. In order to complete the scale, more development was recognized, which included the identification of measurement items important to the real estate industry. According to Alsos. G et al., (2007), additional confirmation of the measure's universality would be beneficial, which this study proposes to use. The Dynamic Capabilities index should be evaluated on sub-samples of various sorts of enterprises based on their size, age, industry, and geographic location, demonstrating the value of applying the operationalized dynamic capacities theory to the real estate market in Kenya. According to Eisenhardt and Martin (2000), dynamic capabilities may be experimentally tested using a binary variable, such as whether or not a firm has a best practice, procedure, or routine that constitutes a dynamic capacity (Laaksonen & Peltoniemi, 2016). Researchers may utilize this method to create a dynamic capability 'profile' for each business, which can then be used to make comparisons. In order to develop a model for evaluating agility in the real estate, we operationalized the dynamic capabilities theory using the format in Table 2.

	Variable	Construct Definition	Measurement Items (Indicators)	Metric
BUSINESS AGILITY	Sensing Opportunity	External Observation and evaluation	❖ The organization systematically search for new business concepts through observation of processes in the environment.	Likert scale
			❖ The organization systematically benchmark the firm with the best in the industry.	Likert scale
			❖ The organization systematically bring together creative and knowledgeable persons within the firm to identify new business opportunities.	Likert scale
			❖ The organization systematically identify which resources the firm can benefit from (financial, competence, political, organizational).	Likert scale
			❖ The organization regularly develop written strategies.	Likert scale
			❖ Technology adoption(Big data analytics tools)	Likert scale
	Respond(Seizing opportunity)	Internal resource renewal	❖ Compared to our competitors, our organization cooperates more closely with our customers about innovation and R&D.	Likert scale
			❖ Compared to our competitors, our organization searches more actively for new partners for competence development.	Likert scale
			❖ Firm networks are used as knowledge resources.	Likert scale
			❖ Employees' networks are important information sources for the firm.	Likert scale
	Transform or Adapt(Managing threats & reconfiguration)	External resource acquisition	❖ Firm has specific plans for R&D activity.	Likert scale
			❖ Firm management is involved in R&D processes.	Likert scale
			❖ Employees contribute with new product/service ideas to a larger extent than those of our competitors.	Likert scale
			❖ Employees and managers are strongly encouraged to promote new visions, goals and ideas.	Likert scale
		Internal resource reconfiguration	❖ Reconfiguration and transformation	Likert scale
			❖ Knowledge creation routines & ❖ Knowledge integration	Likert scale
			❖ Internal flexibility capability	Likert scale

Table 2 : Proposed Operationalization of Dynamic Capabilities (Alsos. G et al, 2007 and Madsen, 2010)

2.7 Related Work and Gaps Identified

By enhancing our understanding of the integration between big data and risk management in business processes, with particular reference to corporate real estate, Battisti et al. (2019) concentrated on big data and risk management in business processes and the implications for corporate real estate. This conceptual research adheres to the tactical strategy for synthesizing coherence in the process of structuring intertextual coherence. It is supported by a wealth of theoretical data from literatures on corporate finance and company management. A new conceptual framework for corporate real estate is introduced in the research study, and it may be utilized to

provide proactive insights into the potential advantages of big data as a business strategy. The technique was developed to facilitate improved risk management and decision-making processes. It should be emphasized, however, that the proposed conceptual framework has not been tested on a specific case study. The research focuses on the opportunities that big data presents in the areas of risk, with implications for risk management and decision-making. It pays little attention to how real estate companies are evolving in response to recent technological advances, with a particular focus on how much attention they are giving to the theme of digital transformation, which could be fueled by new technological platforms.

DeLisle et al. (2019) focused on the big data regime shift in real estate. It uses inductive reasoning, which can result in better real estate judgments, to examine the advent of the big data regime and the disruption it is producing for the real estate business. The study's conclusions show that traditional and non-traditional data may be combined to create a unified data environment to enable better decision-making. The research study demonstrates how socially responsible development may be targeted to underserved metropolitan areas and support inhabitants and the communities in which they live via the use of design thinking. To show how big data may be used to enhance decision-making, the study, which was limited to the US market, presented a fictional project.

The scope of big data management in commercial banks, its advantages, its difficulties, and its influence on business value were all examined by Mbaluka (2013). A descriptive survey was utilized in this study to show that Kenya's banking sector is still in the early stages of big data management activities. Banks are using a range of big data management techniques without being able to keep up with the competition. The study also outlines the considerable obstacles that banks face when it comes to the adoption and appropriate use of big data management. Understanding current data assets may help generate more efficient big data use cases by auditing and using information that already exists in corporate data sources. The study is noted to only focus on the banking sector and presents a need to diversify the study into other sectors so as to validate the findings of the study.

Karuga (2019) in her study focuses on the adoption of big data and the importance of accurate decision making to sustain competitiveness. The research looked at how much telecommunications, telecommunication service providers, ICT businesses, service providers, and a large university had embraced big data analytics, the variables that impacted adoption, and the appropriateness of the model employed to establish this adoption in their operations. According to

the study's findings, the selected organizations have heavily invested in big data analytics. In their operations, the companies employed business intelligence, big data, and predictive analytics. Technological, organizational, and environmental variables all affected the adoption of big data. The degree of interoperability with big data analytics with current IT systems, top management support, organization size and structure, and competition intensity were identified as the factors with the greatest impact on big data analytics adoption. The study looked into the adoption of big data analytics and the elements that influence it in the businesses that were chosen. The study did not, however, examine the efficiency and usefulness of big data in these businesses. This article opens the door for further research into the business implications of big data use in industries other than those covered in this study such as the Real Estate sector.

In his study, Ouma (2020) aimed to understand how the selected state-owned entity in Kenya can create value, intensify agility and eventually improve the general performance by using big data analytics. The key objectives were to determine the effect of people capabilities, task capabilities and data capabilities of big data analytics on the operational agility of the selected state-owned entity in Kenya. The study utilized the cross-sectional descriptive survey design. The use of survey was preferred so as to collect information within a short period of study. It also uses both qualitative and quantitative data collection methods. The study found that all three variables (people, task and data capabilities) significantly influenced operational agility at the Huduma center since they were all positive significant predictors of operational agility. A limitation identified by Ouma (2020) is that the study focuses on one Government owned entity in Kenya that can be argued to contain different organizational structures compared to privately owned firms. The study also suggests further study on how utilization of big data analytics for operational agility can be achieved in non-governmental institutions.

Battisti et al. (2019) aimed to increase knowledge of how big data and risk management are integrated in business operations, with a focus on corporate real estate. The study used the synthesized coherence tactical method. It is a conceptual study since it relies significantly on published theoretical evidence. The article proposes a new conceptual framework for real estate businesses to generate proactive insights into the potential benefits of big data as a business strategy. This strategy was discovered to improve decision-making processes and risk management. The research, on the other hand, falls short of evaluating whether integrating big

data into a real estate firm's business operations will have any impact on the firm's business agility, and it fails to mention agility as a potential big data advantage.

2.7.1 Research Gap as Contextualized for Kenyan Real Estate Firms

In order to analyze the influence of use of big data analytics in business agility in the Real estate firms in Nairobi, it is imperative to analyze the strategic alignment that exists between real estate businesses and IT. This strategic alignment is what enhances business agility within the different sectors of the real estate industry (Munawar et al., 2020). For instance, the big analytic tools used in the real estate sector in the country are a huge determiner of whether the real estate firms are growing on an expedite level or gradually. For the firms that believe they are agile, it is important to establish whether this is an advantage of proper implementation of big data analytics within their organizations. It is also necessary to look at the efficiency and usefulness of big data in the real estate firms by establishing its data sources and influence in the real estate firms in Kenya. It is therefore important to identify how real estate firms currently measure business agility and research the influence of use of big data analytics on the said business agility of a real estate firm in Kenya.

2.8 Conceptual Framework

The COVID-19 pandemic has been linked to lower sales and revenues as a result of lockdowns to preserve lives and/or income reductions for households (Juergensen et al., 2020; Klein & Todesco, 2021; Pedauga et al., 2022). During a health crisis, a high degree of digitalization is still essential to keep the economy going (Chamola et al., 2020; Teodorescu, 2014). Findings imply that the economic damage caused by the SARS outbreak in 2003 was lessened by digital technology (Katz et al., 2020). Information technology in particular can help people be more resilient, organize information, and make decisions when faced with uncertainty (Chamola et al., 2020; Katz et al., 2020; Teodorescu, 2014). Firms' dynamic capabilities define how they reorganize and integrate their resources in response to changes in them environment. As a result, dynamic capabilities assist businesses in detecting and responding to opportunities and risks. Because business agility combines these traits and is used to develop and alter other capabilities, it is a dynamic capability. Based on the hypotheses and model, this research study carefully designed the measurement items for each construct. In this study, BDA is supposed to be evaluated by the extent and frequency of being used in organizations, data sources used in the organization, influence of BDA in the organization and the benefits attributed to the use of BDA. Business Agility variables used in this

study were categorized into three, i.e. Sensing opportunity, Seizing opportunity and Adapting or transforming (Managing threats & reconfiguration) and measurements for each of them were designed based on operationalized dynamic capability theory. Consistent with existing theoretical and empirical evaluations, this study adopted the below conceptual framework in order to analyze the influence of use of big data analytics on sensing, seizing and reconfiguration capabilities (Business agility) in the real estate firms in Nairobi.

Figure 5: Proposed Conceptual Framework (Drydakis, 2022).

3 RESEARCH METHODOLOGY

3.1 Overview

This chapter offers a compendious review of the research undertaking for this study. It outlines the methodology approach that was pursued in collecting data, the research design, as well as the limitations of the study. The section also offers the instruments that was applied in collecting information and the rationale/justification behind such choices.

3.2 Research Design

We used a variety of study designs to reach and meet the different objectives of this work. The descriptive research approach was used to fulfil the overall goal of this study, which was to evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi. In a descriptive design, the only goal of the researcher is to describe the circumstance or case being studied. The process of designing it is theory-based and include gathering, analyzing, and presenting data. This gives a researcher the ability to describe the goals and methods of their research. To help address the study questions, both qualitative and quantitative data were gathered. Below is research method used to achieve the objectives of this research.

Objective	Methods	References
O1: To investigate the use of technology and data specifically BDA in business agility.	- Literature review	Battisti et al., 2019, Gunasekaran et al., 2017, Oliveira-Dias et al.,2022, Giannakis & Louis, 2016, Teece et al., 2016.
O2: To review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi.	- Literature review based on the Dynamic capabilities theory and Comprehensive agility measurement tool. - Qualitative method - Data collection tools- Use of a Questionnaire - Analysis - Quantitative data analysed by Excel to generate graphs and tables to represent the data and also SPSS for the generation inferential statistics, and descriptive statistics	Drydakis, 2022, Warner & Wäger, 2019, Liu et al., 2018, Somanath et al., 2013, Alsos. G et al, 2007, Madsen, 2010, Laaksonen & Peltoniemi, 2016.

Objective	Methods	References
O3: To evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi.	- Mixed methodology - Quantitative and Qualitative data collection. - Data collection tools- Questionnaire with both open ended and closed ended questions. - Analysis – Qualitative data analyzed by thematic procedure. - Quantitative data analysed by Excel to generate graphs and tables to represent the data and also SPSS for the generation inferential statistics, and descriptive statistics	Winson-Geideman and Krause, 2016, Du et al., 2014, Puckett, 2021, Jara, 2022, Marangu, 2021, Bright Data LTD, 2022, Battisti et al., 2019,

Table 3: Research Methods

3.3 Population and sampling

This research undertaking focused on the analysis of big data analytics on business agility in the real estate sector in Nairobi. The Kenyan real estate sector majorly operates from the capital city, Nairobi, which is part of the larger Nairobi Metropolitan Area. Using convenience sampling, it was practical to affirm that most of the real estate firms in Kenya are headquartered within the Nairobi Metropolitan Area, an area that consists of five counties; namely, Nairobi County, Kajiado County, Kiambu County, Murang'a County, and Machakos County. The research focused on real estate firms with a revenue of more than $10M as listed in the real zoominfo database in literature (ZoomInfo, 2021). Convenience sampling is an instrumental non-probability sampling technique applied in drawing a representative sample from a given population that is easily and practically close to hand (Joshi, Kale, Chandel & Pal, 2015). By applying convenience sampling technique, the real estate sector was represented by firms that are located within the Nairobi Metropolitan Area, due to the IT-orientation and growth of big data usage within this section of the country. Guma and Monstadt (2021) assert that these counties are the most developed in terms of ICT infrastructure, a paramount feature into how big data analytics is used and applied by real estate firms and proliferated to other sectors of the Kenyan economy.

Real Estate Firms	A	B	C	D	E	F	Total
Sample population	6	10	6	6	7	5	40

Table 4: Sample Size

3.4 Tools and methods for Data collection

This study used the questionnaire as the data collection tool for the research. The questionnaire entailed questions derived from both the Comprehensive agility measurement tool and the operationalized dynamic capabilities theory, which was the method for evaluating agility for this study. The questionnaire was divided into sections, which collected the demographic data, questions aimed at addressing research question two and the last section aimed at addressing research question three. Therefore, the questionnaire contained both open-ended questions and closed-ended questions in form of Likert scale.

The online questionnaire was emailed and sent via WhatsApp to various respondents working at the selected real estate firms. In quantitative research, as opined by Boone and Boone (2012), a Likert scale was applied to measure the respondents' agreement to a selected choice of statements. The research participants were the individuals working at the various real estate firms who have agreed to willingly be part of this research undertaking.

3.5 Data Analysis Methods

Due to the mixed nature of the data, analysis involved two different procedures. The data collected qualitativley was analyzed through a thematic procedure (see fig. 5). Thematic analysis entails to asssessing qualitative data by interpreting, identying, and categorizing patterns (Gibbs, 2013). Such patterns were later on identified as themes, often aligned to answer applicable research questions and the main aim of the research undertaking (Neil, Rose, & Clark, 2009). Justifiably, qualitative data was analyzed using textual analysis the various opinions, narratives, stories, and suggestions and categorize into business agility variables (Sense, adapt, respond).

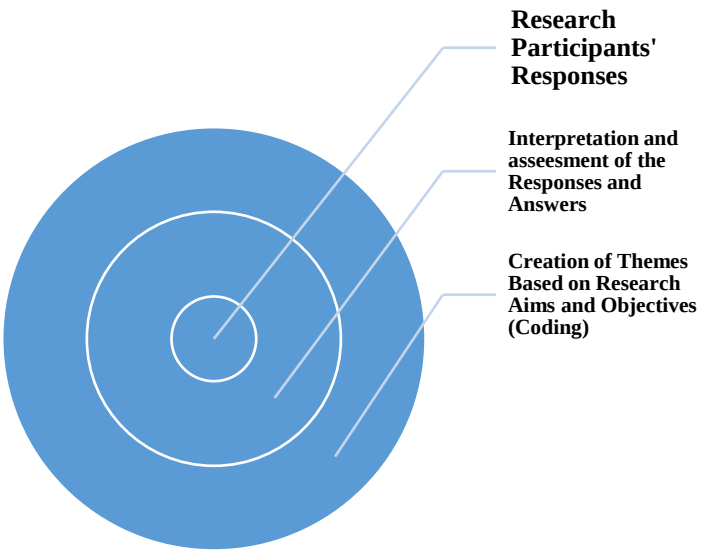

Figure 6: Thematic Analysis' Coding Grid, as Conceptualized (Neil. H, et al., 2009).

The quantitative data was analyzed using Excel to generate graphs and tables to represent the data and also SPSS for the generation inferential statistics, and descriptive statistics. Data cleaning was done to differentiate quantitative data from qualitative data and remove any errors and inconsistencies. Quantitative data was coded into numerical before being imported into SPSS software for analysis. In SPSS, the variables were also coded and defined numerically according to the data in the CSV form in order to allow proper analysis by the tool. Descriptive statistics was carried out which includes measures of frequency. To measure reliability, Cronbach's Alpha was used in this study. In order to understanding the relationship between the selected variables, and business agility, the study used multicollinearity test, regression analysis, inferential statistics such as mean value, standard deviation, average scores and analysis of variance. These helps to explore patterns and confirm hypotheses.

3.6 Research Validity and Reliability

Peer-reviewed sources and several academic data sources were employed in this research study for all of the chapters, which was a crucial aspect in ensuring the accuracy of the data that was used. This academic commitment was essential to further the authenticity of the study, since the usage of reliable sources confirms that the references are accurate and genuine (Creswell, 2012). It is crucial to use peer-reviewed materials in qualitative research as a source of reference that can be used to compare and contrast various study findings on the issue (Miller, 1986).

If the same research methods are used again, will the outcomes be the same? This is what research dependability refers to (Miller, 1986). Cronbach's alpha approach was applied to Likert scale items to assess the research instruments' internal consistency. This approach is preferred because of its unique capacity to determine the internal consistency and reliability of the study instrument. Cronbach's alpha reliability coefficient ranges from 0 to 1, with values near to one indicating that the Likert scale products have a high level of internal consistency. This research ensured research validity through the use of administration of an open-ended questionnaire to collect qualitative data. Research validity entails to how effective a research-collecting instrument does its intended job while collecting research information (Creswell, 2009). The questionnaire being administered to willing participants allowed the effective and efficient aid in collecting qualitative data, a factor that fosters validity of the findings.

3.7 Ethical Consideration

Research ethics was an imperative part of the research process, ensuring that a set of standards is adhered to before and after conducting any given research. The regulation of the University of Nairobi for was followed. In addition, in order to adhere to a code of ethics, a consent form, establishing the privacy and confidentiality protocols to be followed, was sent to participants who needed persuasion on the privacy of the research (see Appendix 1). The research participants were the individuals working at the various real estate firms who agreed to willingly be part of this research undertaking. An inclusion of the consent form aided the research participants to be more honest and truthful since they have no fear of their responses being shared with fellow colleagues, family members, and/or friends but it was noted that majority of the participants did not require the consent form but willingly offered to participate in the research. Such a privacy guarantee increased research reliability, credibility, and validity (Creswell, 2013). In addition, confidentiality is paramount if research participants are disclosing information that might be sensitive within their real estate job description. Hence, such ethical considerations aided in increasing people who are open to be research participants, aided in proper data collection that will fostered meaningful research deductions.

4 RESULTS AND DISCUSSION

4.1 Overview

In the current highly competitive marketplace, the ability to achieve agility and work faster gives competitive edge to businesses (Ali & Siniak, 2020). In this study, the primary focus was to analyze the influence of use of big data analytics in business agility in the Real estate firms in Nairobi. The growing significance of big data in driving business agility made this research necessary. This segment encompasses the responses for both the qualitative and quantitative data and a correlation between the dependent and independent variables.

4.2 Rate of Response

This study collected data from 40 research participants/respondents. The research participants comprised of IT administrators, human resource analysts, managers, project managers, investors, business development analysts, sales representatives, brand and marketing specialists, finance consultants, legal associates, IT associates, and sales and marketing executives of different real estate firms in Kenya. The study collected data from this category of participants because they had vast knowledge and experience about the applicability of big data analytics and its tools in the real estate industry in Kenya. Similarly, this group of respondents/participants was better positioned to key out challenges and benefits of using big data in their respective roles in the real estate firms in Nairobi.

The majority of the respondents (90%) returned the questionnaires wholly answered. Conversely, 10% were not fully responded, while some were poorly answered. Thus, it depicts that most participants were more concerned and determined to respond to the research topic.

Category	**Participants Frequency**	**Participants Percentage**
Participants' Response	36	90
Participants' Non-response	4	10
Total	**40**	**100**

Table 5 : Indicates the Percentage of Participants' Rate of Response

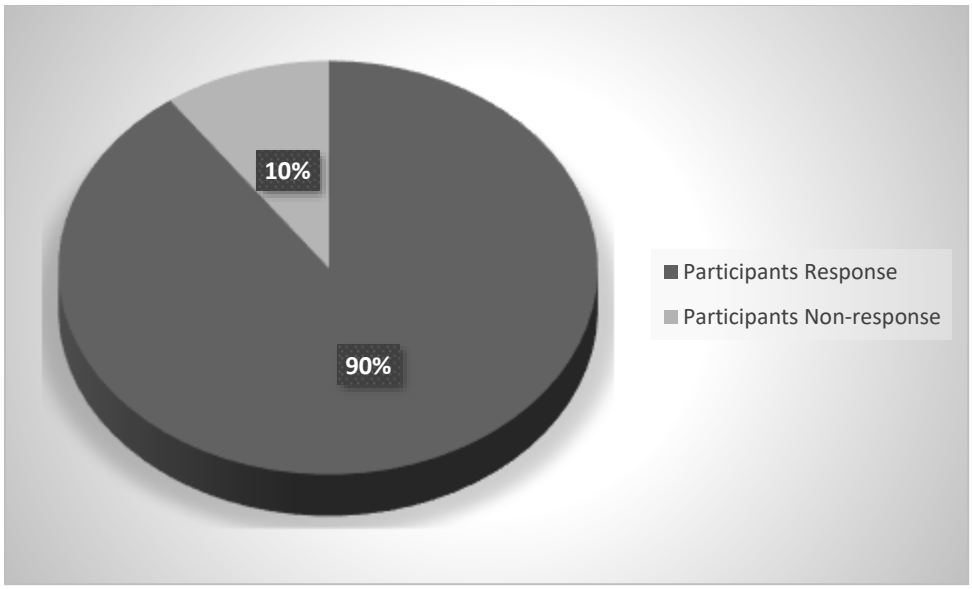

Figure 7: Indicates the Percentage of Participants Rate of Response

4.3 Reliability Analysis

Cronbach's Alpha was used for the study's reliability analysis. This test evaluates the dependability and internal consistency of any research instrument employed in the study. Alpha values must be greater than 0.6 for the study to be successful. The training's Cronbach's alpha was 0.806, which indicates that it was successful since the result was satisfactory. The outcomes are shown in the table below.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.806	.778	38

Table 6 : Reliability Analysis

4.4 Demographic Information

4.4.1 Respondents Age

The age analyses of the participants or employees are as follows: the respondents below 25 years were 14%, while the age response from respondents between 25 to 35 years was 58%. Conversely, 19% and 8% were participants between 36 to 45 and 46 to 65 years, respectively. Finally, there were no participants between age 66 to 75 and above 75 years with both registering 0 participants. A majority of the real estate employees were between the age bracket 25 to 35, which means that most staff were young people and one could associate this to the fact that the young are technologically savvy.

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 25	5	13	14	14
	25-35	21	53	58	72
	36-45	7	18	19	92
	46-65	3	8	8	100
	Total	36	90	100	
Missing	System	4	10		
Total		40	100		

Table 7 : Depicts Respondents Age Response

4.4.2 Participants' Gender

The respondents who participated in the conveying responses for the research undertaking, offering constructive data depicted that the majority were male at 56%; while 44% accounted for were females. The research target both gender to ensure equality and get information on the perception of both genders towards business agility in the real estate firms in Kenya.

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	26	65	72	72
	Female	10	25	28	100
	Total	36	90	100	
Missing	System	4	10		
Total		40	100		

Table 8 : Portrays Participants Sex

4.4.3 Sector of Real Estate Economy

The majority of the respondents (89% in total) indicated that they consider their organization as part of the private sector which contributes significantly to the real estate economy. On the other hand, 11% of the respondents were from the public sector. Therefore, it can be concluded that a large percentage of the real estate market consists of the private companies in Kenya that have

invested in the real estate business and they maintaining a strategic aim at substantially contributing to its growth and economic prosperity.

Real Estate Sector					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public Sector	4	10	11	11
	Private Sector	32	80	89	100
	Total	36	90	100	
Missing	System	4	10		
Total		40	100		

Table 9 : Showing the Sector of Real Estate Economy

4.4.4 Number of Employees

The study aimed to determine the number of employees in the Real estate firms. Employee numbers give an indication of the size of the organization and its investment in human capital. 83% of the respondents indicated that their organization has 100-500 employees, 14% indicated that their organization has less than 50 employees while 3% indicated that they have 51-100 employees. This implies that the real estate firms have an average human capital investment.

Number_of_Employees					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 50	5	13	14	14
	51-100	1	3	3	17
	100-500	30	75	83	100
	Total	36	90	100	
Missing	System	4	10		
Total		40	100		

Table 10 : Number of employees in an organization

4.4.5 Which Category Does Your Organization Fit in Within the Real Estate Spectrum?

The majority of the research respondents (33%) indicated that their companies were in the investments category in the real estate spectrum, whereas 21% were in the development category. On the other hand, 16% and 14% were in property management sector and the sales and marketing

sector respectively. Furthermore, lending and Professional services were at 9% and 7% respectively. None of the respondents identified brokerage as a category in which their firms or organizations would fit in hence the 0%. The increase in number of respondents indicates that most real estate firms have a diverse portfolio of services offered and do not only offer one specific service to its client. This can be deduced as being agile and adapting to the various customer needs within the market.

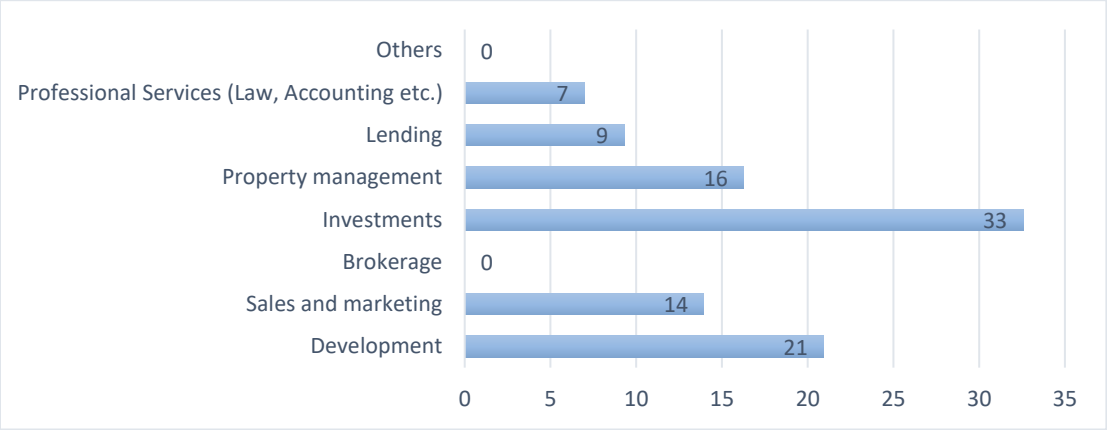

Figure 8 : Showing Different Categories That Real Estate Organizations fit in Within The Real Estate Spectrum in Kenya

4.5 Objective 2: To review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi.

4.5.1 Would you Consider Your Organization Agile?

Most of the research respondents (94% in total) indicated their organizations as being actively agile. According to Guma and Monstadt (2021), such changes may result from external and internal factors. As a result, the various real estate Kenyan organizations can respond effectively, flexibly, and rapidly to consumer needs. Therefore, the firms becomes productive and adapts cost-effective approaches, which aids in the provision of quality (Ouma, 2020). On the other hand, 6% of the respondents disagreed that their organizations were agile.

Is your Organization Agile?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	85	94	94
	No	2	5	6	100
	Total	36	90	100	

Missing	System	4	10		
Total		40	100		

Table 11 : Depiction of Whether the Respondents Would Consider Your Organization Agile

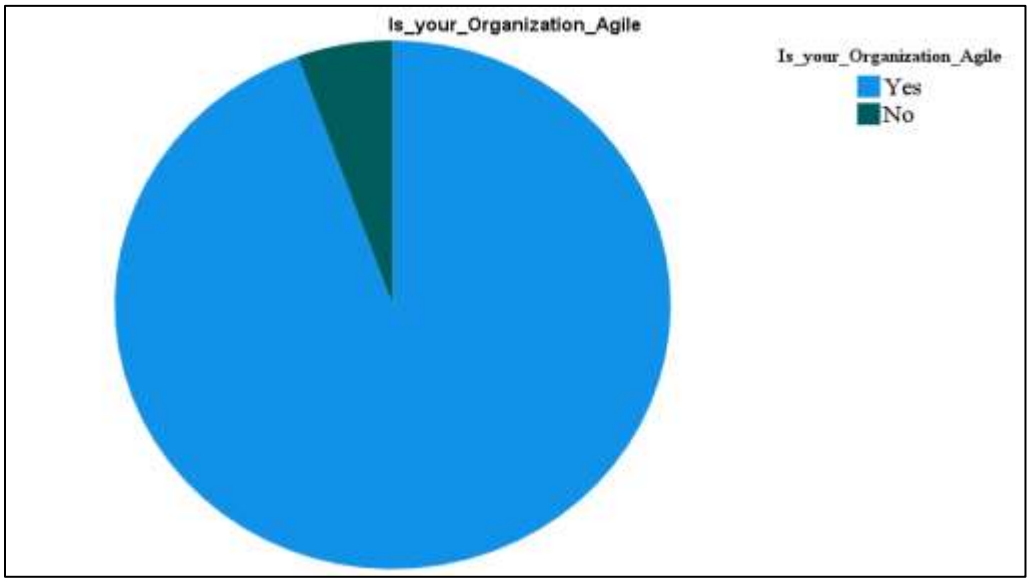

Figure 9 : Depiction of Whether the Respondents Would Consider Your Organization Agile

4.5.2 Multicollinearity Test

Multicollinearity exists when two or more predictors are correlated into the model and provide redundant response information. This test was carried out to determine that the metrics selected to measure business agility do not provide overlapping answers and also do not test similar items in business agility. Multicollinearity was calculated by inflation variance and resistance factors. There is a problem with multicollinearity if the VIF value is more than 4.0 or the tolerance value is less than 0.2. (Hair et al, 2010).

Model			Collinearity Statistics	
1		(Constant)	Tolerance	VIF
	Sensing Capabilities	Systemic Search for New Business Concepts	.530	1.888
		Benchmark with Industry	.329	3.039
		How Often Does this Happen	.327	3.058
		Creatives Identify New Business Opportunities	.550	1.817
	Respond capabilities	Customer Input in Research & Development	.549	1.822
		Employee Contribution	.473	2.114

		Management Involvement	.387	2.585
		Use Big Data analytics tools	.581	1.721
		Technology adoptions	.355	2.818
	Transforming Capabilities	No of RE Problems Faces and Solved	.557	1.795
		Percentage of Work Balanced Compared to Project Delivery Time	.539	1.854
		RE product Diversity	.607	1.648
		No of Training Skill Development Programs	.425	2.354
		Routines to reconfigure the firms resources in new ways	.609	1.642
		Profit Increase from Past Year	.698	1.433

Table 12 : Tolerance and VIF value for independent variables

Metrics such as the Employee Attrition and internal customer satisfaction were noted to have high VIF scores of more than 4, thus excluded from the Multicollinearity test. As the table shows, no item left has a tolerance value of less than 0.20. In addition, no item has a value of more than 4. This is an indication that the collinearity is not present implying that no metric or variable in the above table contains redundant information.

4.5.3 Regression Analysis

This analysis aid in understanding the relationship between the selected metrics, and business agility. The data indicates that the metrics selected have an influence on business agility by 96.0%. The key information from the table below is the R^2 value of 0.921. This indicates that the model containing the selected metrics can explain 92.1% of business agility. Given that this is relatively high, the regression equation's predictions may be trusted. Additionally, it indicates that 7.9% of the variation is still unaccounted for, which might make the model fit better by including additional independent variables. The minimum value for R square should be more than 30%, so this is a decent model, is suitable for further study, and can be adopted by other researchers as well.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

1	.960[a]	.921	.861	.10583

Table 13 : Regression analysis

4.5.4 Analysis of Variance

The ANOVA table explains the variance as a result business agility with the aid of the listed business agility measuring metrics. 2.602 out of 2.826 is explained by the independent variables, while the balance (0.224) is explained by variables outside the study. This further indicates that the independent variables in the model are significant in measuring business agility in a real estate firm in Kenya.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.602	15	.173	15.487	<.001[b]
	Residual	.224	20	.011		
	Total	2.826	35			

Table 14 : ANOVA Table

4.5.5 Regression Analysis- Coefficients

The study findings indicated in the table below show that there was a significance relationship between Technology adoptions (p = 0.003), Creatives Identify New Business Opportunities (p = <.001), and Number of completed Training/Skill & Development Programs (p = <.001) when regressed with the business agility metrics. The number of technology adoptions, systematically bringing together creative and knowledgeable persons within the firm to identify new business opportunities and Training / Skill Development Programs Completed in an organization likely indicate business agility in a real estate firm in Kenya since they are below 0.05, and if p<0.05 means we reject the null hypothesis and accept the alternate hypothesis. The findings indicate that mentioned metrics are likely indicators of Business Agility in a real estate firm in Kenya.

Coefficients[a]							
Model			Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
1		(Constant)	.646	.341		1.892	.073
	Sensing Capabilities	Systemic Search for New Business Concepts	.027	.077	.031	.353	.728

		Benchmark with Industry	.113	.089	.139	1.269	.219
		How Often Does this Happen	.067	.034	.215	1.950	.065
		Creatives Identify New Business Opportunities	.126	.030	.359	4.228	<.001
	Respond capabilities	Customer Input in Research and Development	.067	.023	.249	2.935	.008
		Employee Contribution	.037	.029	.118	1.290	.212
		Management Involvement	.009	.048	.020	.199	.844
		Technology adoptions	.087	.025	.361	3.416	.003
		Use Big Data analytics tools	-.024	.026	-.077	-.928	.365
	Transforming Capabilities	No of RE Problems Faces and Solved	-.012	.034	-.031	-.364	.720
		Percentage of Work Balanced Compared to Project Delivery Time	.047	.033	.121	1.407	.175
		RE product Diversity	.062	.024	.211	2.612	.017
		No of Training Skill Development Programs	.094	.023	.397	4.115	<.001
		Routines to reconfigure the firms resources in new ways	.065	.023	.231	2.869	.009
		Profit Increase from Past Year	.069	.029	.178	2.365	.028

Table 15 : Coefficients Table

4.6 Objective 3: To evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi.

4.6.1 What is the frequency of the use of Big Data Analytics Tools within Your Job Description?

Majority of the respondents (58%) indicated that they frequently use big data analytics tools within their job description. The study pool of the respondents was composed of IT administrators, human resource analysts, managers, project managers, investors, business development analysts, sales representatives, brand and marketing specialists, finance consultants, legal associates, IT associates, and sales and marketing executives. Moreover, 28% of the respondents use it occasionally, while 14% indicated that big data analytics tools were used frequently. Interestingly, no respondents claimed to not utilize big data analytics tools within their job description. Big data analytics is imperative to most real estate economies, aiding in simplifying work-related schedules and meeting customer demands effectively (Ali & Siniak, 2020). The responses indicate that within the Kenyan real estate sector, big data analytics tool are recognized as part of the day-to-day operations of different real estate firms. Therefore, big data analytics can be used to enhance organizational agility in the real estate market by analyzing significant data that aids in gaining competitive advantage (Ali & Siniak, 2020). Thus, big data analytics is essential in analyzing unstructured, semi-structured, and structured data from various sources in distinct capacities such as terabytes, gigabytes, and zettabytes.

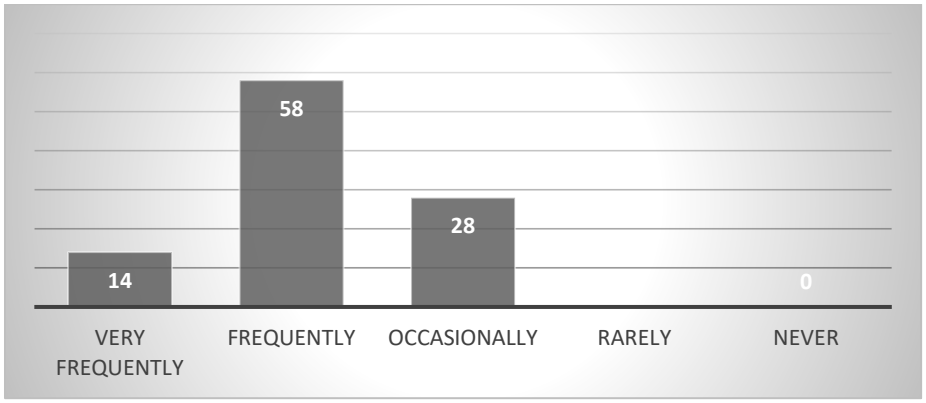

Figure 10 : A Portrayal of Respondents Who Use Big Data Analytics Tools within Their Job Description

4.6.2 To What Extent are the Below Data Sources Utilized in Big Data Analytics in Your Organization

Most of the respondents (26 in total) indicated that big data analytics is utilized in demographic surveys. In the real estate industry, demographic parameters such as age, social class, and gender

are essential in determining the target market and type of products through the technique. Concurrently, most respondents (28) postulated that customer satisfaction data is utilised during data analytics in Real estate firms. Through the market surveys, such generated data is essential in determining consumer behavior and tastes and preferences (Couto, 2015). Conversely, 31 and 25, who represented the majority of participants, indicated that the data analytics tool is essential in real estate market information involving report and financial transactions. Such big data application has been credited to the decisions made by project managers (Cytonn Real Estate, 2021.) Finally, most of the research participants, 28 and 22, posited that data analytics tools are significant for social media and online surveys, as well as telephone conversations.

	No extent at all	Little extent	Moderate extent	Great extent	Very great extent	Mean	Median	Std. Deviation
Demographic surveys	0	0	6	26	4	3.94	4.00	.532
Customer satisfaction data	1	1	4	28	2	3.81	4.00	.710
Real estate Market Information and reports	0	0	2	31	3	4.03	4.00	.377
Real estate Financial transactions	0	3	7	25	1	3.67	4.00	.676
Telephone conversations	2	5	5	22	2	3.47	4.00	1.000
Social media and online surveys	3	0	2	28	3	3.72	4.00	.974
Average						**3.773**		
Other (Please Indicate)								

Table 16 : Depiction of the Extent That Data Sources are Utilized within Big Data Analytics in Organizations

4.6.3 Influence of BDA on sensing capabilities

As presented on table 19, the analysis of the influence of use of big data analytics on the sensing capabilities of business agility indicate that the selected variables were influenced by use of big data analytics to a great extent. This is noted by the average mean value of 3.993. 'The use of Big data analytics has Enhanced the search for new business concepts' had a mean value of 3.83 and

standard deviation of 0.878, 'The use of Big data analytics has Increased competitive advantage' had a mean value of 4.11 and standard deviation of 0.465 and finally 'The use of Big data analytics has increased the understanding of customer needs better' had a mean value of 3.86 and standard deviation of 0.351.

Descriptive Statistics						
	N	Min	Max	Mean	Std. Deviation	Variance
The use of Big data analytics has Enhanced the search for new business concepts	36	1	5	3.83	.878	.771
The use of Big data analytics has Increased competitive advantage	36	3	5	4.11	.465	.216
The use of Big data analytics has increased the understanding of customer needs better	36	3	4	3.86	.351	.123
Average				**3.933**		
Valid N (listwise)	36					

Table 17: Influence of use of big data analytics on Sensing capabilities

4.6.4 Influence of BDA on seizing capabilities

According to the statistics carried out on the influence of the use of big data analytics on the seizing capabilities of business ability, it is notes that the selected variables were influenced by big data analytics to a great extent. This is noted by the average mean value of 3.764 as presented in table 20. 'The use of big data analytics has resulted in increased percentage of real estate projects delivered on time' had a mean value of 3.69 and standard deviation of 1.064 whereas 'The use of Big data analytics has resulted in improved number of technology adoptions done' had a mean value of 4.08 and standard deviation of 0.692. 'The use of Big data analytics has resulted in Improve decision-making', 'The use of Big data analytics has resulted in Real estate product diversity within the organization' and 'The use of Big data analytics has resulted in Improved accurate property evaluations' had a mean value of 3.83, 3.50 and 3.72 respectfully and a standard deviation value of 0.737, 0.910 and 0.701 respectfully.

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance

The use of Big data analytics has resulted in increased percentage of real estate projects delivered on time	36	1	5	3.69	1.064	1.133
The use of Big data analytics has resulted in improved number of technology adoptions done	36	2	5	4.08	.692	.479
The use of Big data analytics has resulted in Improve decision-making	36	1	5	3.83	.737	.543
The use of Big data analytics has resulted in Real estate product diversity within the organization	36	1	5	3.50	.910	.829
The use of Big data analytics has resulted in Improved accurate property evaluations	36	1	5	3.72	.701	.492
Average				**3.764**		
Valid N (listwise)	36					

Table 18: Influence of use of big data analytics on Seizing capabilities

4.6.5 Influence of BDA on transforming capabilities

As presented in table 21, the results of the analysis shows that use of big data analytics influenced the transforming capabilities of business agility to a great extent with an average mean value of 3.464. The mean values of the variables used in this analysis were noted to have a highest mean value of 3.69 and a minimum of 3.19. Similarly, the variables analysed were noted to have a minimum standard deviation value of 0.882 and a maximum of 1.206.

'The use of Big data analytics has resulted in reduced percentage of Attrition for Employees' had a mean value of 3.19 and standard deviation of 1.009, 'The use of Big data analytics has resulted in increased of Profits from Past Year' had a mean value of 3.72 and standard deviation of 0.849 and 'The use of Big data analytics has resulted in increased the Number of Training Skill Development Programs' had a mean value of 3.28 and standard deviation of 0.882. 'The use of

Big data analytics has resulted in improved risk management' and 'The use of Big data analytics has resulted in increase in the number of successful continuous improvement projects undertaken in your organization' had a mean value of 3.69 and 3.44 respectfully and a standard deviation value of 0.889 and 1.206 respectfully.

Descriptive Statistics						
	N	Min	Max	Mean	Std. Deviation	Variance
The use of Big data analytics has resulted in reduced percentage of Attrition for Employees	36	1	4	3.19	1.009	1.018
The use of Big data analytics has resulted in increased of Profits from Past Year	36	1	5	3.72	.849	.721
The use of Big data analytics has resulted in increased the Number of Training Skill Development Programs	36	1	4	3.28	.882	.778
The use of Big data analytics has resulted in improved risk management	36	1	5	3.69	.889	.790
The use of Big data analytics has resulted in increase in the number of successful continuous improvement projects undertaken in your organization.	36	1	5	3.44	1.206	1.454
Average				**3.464**		
Valid N (listwise)	36					

Table 19: Influence of use of big data analytics on Transforming capabilities

4.6.6 Correlation Analysis

The correlation analysis shows the variables of sensing, seizing and transforming significantly correlated to the dependent variable big data analytics use. As indicate on Table 22, all the variables had significant and positive correlation ($p<0.05$) with the least value of Pearson correlation=.526 and a highest value of Pearson Correlation=.748.

Correlations					
		BDA_USE	SEIZING	TRANSFORMING	SENSING
BDA_USE	Pearson Correlation	1			
	Sig. (1-tailed)				
	N	36			
SEIZING	Pearson Correlation	.627**	1		

	Sig. (1-tailed)	<.001			
	N	36	36		
TRANSFORMING	Pearson Correlation	.608**	.731**	1	
	Sig. (1-tailed)	<.001	<.001		
	N	36	36	36	
SENSING	Pearson Correlation	.526**	.748**	.569**	1
	Sig. (1-tailed)	<.001	<.001	<.001	
	N	36	36	36	36
**. Correlation is significant at the 0.01 level (1-tailed).					

Table 20 : Correlation analysis – Full Model

4.6.7 Regression Analysis

This analysis aid in understanding the relationship between the use of big data analytics in real estate firms in Kenya and the categorized business agility variables. The data indicates that the use of big data analytics has an influence on business agility by 62.0%. The key information from the table below is the R^2 value of 0.620. This indicates that the model containing the selected metrics can explain 62.0% of business agility variables (sense, seize and transform). The minimum value for R square should be more than 30%, so this is a decent model, is suitable for further study, and can be adopted by other researchers as well.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.787[a]	.620	.616	.26612

Table 21 : Regression analysis – Full Model

Analysis of Variance

The ANOVA table explains the variance as a result big data analytics use with the aid of the listed business agility measuring variables. 25.663 out of 28.750 is explained by the independent variables, while the balance (3.087) is explained by variables outside the study. This further indicates that the independent variables in the model are significant in measuring business agility in a real estate firm in Kenya.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.663	32	.802	10.283	<.001[b]

	Residual	3.087	3	1.029		
	Total	28.750	35			

Table 22 : ANOVA Table

4.6.8 Regression coefficient

The study findings indicated in the table 23 show that there was a significance relationship between Sensing variable (p = 0.004), Seizing (p = <.001), and Transforming (p = <.001) when regressed with the use of big data analytics in real estate firms. Sensing capabilities, seizing capabilities and transforming capabilities are likely indicators business agility in a real estate firm in Kenya since they are below 0.05, and if p<0.05 means we reject the null hypothesis and accept the alternate hypothesis. The findings indicate that mentioned variables are likely indicators of Business Agility and are positively influenced by big data analytics use in the real estate firms in Kenya.

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.765	1.380		1.279	.210
	SENSING	.123	.525	.359	.035	.004
	SEIZING	.664	.475	.424	1.397	<.001
	TRANSFORMING	.337	.300	.475	1.124	<.001
a. Dependent Variable: BDA_USE						

Table 23 : Coefficients Table

4.6.9 Qualitative Data

The study collected qualitative data using open-ended questionnaires from the key research participants drawn from the sample size selected of real estate firms in Kenya. Using convenience-sampling method, a non – probabilistic sampling approach popularly applied in qualitative research (Creswell, 2009), the researcher identified research participants and respondents from different real estate Kenyan companies. The qualitative data collected from open-ended questions in the interview and questionnaire guides was thematically presented in this section in order to answer the research aims/objectives. Therefore, similar responses collected from divergent research participants were grouped into similar themes after a textual analysis of the various opinions, narratives, stories, and suggestions.

4.6.9.1 Themes Derived from Qualitative Data

The thematic coding was performed through textual analysis. According to Braun and Clarke (2016), the keying process (searching for meaningful and substantially oriented texts) followed in generating any 'theme' needs to be quantified using specific word metrics that factor in the research's aims and objectives. Therefore, the research process used the study's aims and objectives in identifying words that were similar, often used, and related with the final inquiry of this research undertaking.

Research Questions	Sentences that Carried 'Key Words' from respondents	Coded Interpretation Based on the Conceptual Framework	Interpretations Through Coding
Q1: The real estate critical problems faced by your organization and solved in past 1 year. Q2: Has big data analytics positively influenced your organization? Q3: Has real-time data optimization and visualization (big data analytics) had an effect on growth of real estate within your working capacity?	- Through social media surveys the organization has been able to know where it stands in terms of performance and customer satisfaction. - It has largely helped understand the consumer market thus enabling the organization come up with products that suits all the customers. - Helps to understand the market operations - Helps improve upcoming developments by incorporating new ideas and new value add on. - Social media attacks - Capital Market Risks. - COVID-19 disruption. - No centralized documentation management for all stakeholders - Cash flow issues where the organization decided to focus on one project at a time.	Sense	External observations and evaluations
	- Important in analyzing data especially for market research which helps to improve on the real estate products. - Assists in understanding competition. - Improved Product awareness and customer service. - Has enabled the organization to observe trends in the data collected for effective implementation that concludes property handover processes. - Enables data driven decision-making.	Seize	Internal Resource renewal

	- From data is how we get to analyze and make better decisions. - Enabled phasing of our real estate projects. - There is great insight into the products to develop and the pricing to suit client demands.		
	- With big data, we have seen improvement in the quality of leads generated via the CRM. - It has led to targeting of new customers for the business and enhanced retention of existing ones. - In my capacity within the Investments department, most of the data analytics are done by third party platforms that helps in getting the correct information. - It has helped the organization to forecast and plan accordingly. - It has brought about efficient market operations and more innovative products to suit our clients' needs. - It enhances quick understanding of trends for both clients and employees.	Transform	External resource acquisition and internal resource configuration

Table 24 : Coding of Responses into Themes from Answers

4.7 Summary

According to the research, Majority of the respondents (58%) indicated that they frequently use big data analytics tools within their job description. The study pool of the respondents was composed of IT administrators, human resource analysts, managers, project managers, investors, business development analysts, sales representatives, brand and marketing specialists, finance consultants, legal associates, IT associates, and sales and marketing executives. The responses indicate that within the Kenyan real estate sector, data is an integral part of the day-today operations of different real estate firms and analysis the various data sets is key in obtaining meaningful deductions within the various department in a real estate firm in Kenya.

The research also indicted that Real estate market information and reports is a key data source that is used to a great extent in big data analytics with a mean value of 4.03. Demographic surveys, Customer satisfaction data, Social media, Real estate financial transactions, Telephone conversation and online surveys were also data sources that are used moderately in big data analytics. The purpose of this part was to learn which data sources the firms were utilizing for their big data analyses. These also aided us in determining if individuals truly understood the types of data that make up big data. Resultantly, big data provides an opportunity for real estate firms to observe consumer trends and patterns (DeLisle et al., 2019). Using big data tools enables Kenyan real estate firms to learn critical consumer behavior, allowing the businesses to meet consumer needs and preferences. In today's unpredictable market environment, more so in developing nations such as Kenya, big data analytic tools have become an integral source of driving business agility, leading to competitive advantage (DeLisle et al., 2019).

The qualitative data analyzed showed how real estate firms are utilizing big data analytics and the benefits realized in their organizations. This is seen in the data categorized under Sense, Adapt and respond section in table 26. The benefits awarded from the use of big data analytics as analyzed in section 4.6.3 to section 4.6.5 also indicate the mean value of each benefit and most are seen to have a mean value of 4 indicating that the respondents have been assisted by big data analytics in their organization to a great extent to achieve the benefits outlined.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This is the last chapter of the study on the influence of use of big data analytics in business agility in the real estate firms in Nairobi and it presents a summary and discussion of the findings, conclusions, recommendation for improvement as well as proposals on areas for further research. The conclusion will be based on the research objectives and the recommendations will be deduced from conclusion and discussion of the findings.

5.2 Summary of the study

The objective of this research study was to contribute to the understanding of business agility in the real estate firms in Nairobi and the influence of use of big data analytics (BDA) on the said business agility. This is a significant issue since, in terms of ongoing adaptation and value generation; business agility is a core aspect of business process management. To the best of our knowledge, the local real estate industry has not been the subject of study on the relationship between big data analytics (BDA) and agility. This research study was guided by the following three specific objectives: to investigate the use of technology and data specifically BDA in business agility, to review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi and to evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi. Findings of the research are important as they study will serve as a foundation for future academic studies into the domain of big data analytics in the Kenyan real estate sector by academics and researchers. Based on what an organization has gathered to be helpful, the public or clients serviced by businesses that use big data analytics are likely to gain from better service delivery, efficiency, and innovation.

The research study used a descriptive research approach that was used to fulfill the overall objective of this study, which was to examine the impact of big data analytics on business agility in the real estate firms in Nairobi. This helps a researcher to describe the goals and methods of their research. To help address the study questions, both qualitative and quantitative data were gathered. The first objective was realized through literature review on the various documentations available in literature whereas the second objective was realized through literature review and tested using quantitative data gathered by the research questionnaire. The third objective was also realized through the gathering and analysis of both qualitative and quantitative data as shown in the previous chapter.

The study pool of the respondents was composed of IT administrators, human resource analysts, managers, project managers, investors, business development analysts, sales

representatives, brand and marketing specialists, finance consultants, legal associates, IT associates, and sales and marketing executives. The responses indicate that within the Kenyan real estate sector, data is an integral part of the day-today operations of different real estate firms and analysis the various data sets is key in obtaining meaningful deductions within the various department in a real estate firm in Kenya. This study applied the convenience sampling method and collected data from forty research participants/respondents from six organizations. The response rate was 90% from thirty six respondents. The variable of study based on each objective were: the use of big data analytics as independent variables and business agility variables; sense, seize and respond as the dependent variable. Both descriptive and inferential analysis was performed, and the summary of the key findings were as follows:

5.3 Discussion

5.3.1 Objective 1: To investigate the use of technology and data specifically BDA in business agility

The usage of information technology (IT) is one of the most important ways for businesses to improve their agility. For example, data analytics technologies may assist businesses in detecting market shifts and, as a result, enhance their response speed and efficacy; in other words, boost their agility. Tallon, Lu, and Ramamurthy came to the conclusion that IT skills increase business agility (Liu et al.,2019 and Swafford et al., 2011). Oliveira-Dias et al. (2022) cite a number of studies that demonstrate how developing information and digital technologies—more especially, a group of these technologies that have been extensively embraced by businesses, such Big Data, Cloud Computing, IoT, and AI—have an effect on such tactics (Giannakis & Louis, 2016). By providing end-to-end real-time inventory information from suppliers and predicting future changes in product demand, big data may improve supply chain visibility. Big Data may help companies improve their operations, provide better and more prompt customer service, anticipate risks, conform to laws, and be more environmentally conscious. One of the most essential methods for organizations to increase their agility is to use information technology (IT). Data analytics tools, for example, may help organizations notice market developments and, as a result, improve their reaction time and efficacy; in other words, increase their agility. Real estate organizations are using technology like big data to strengthen their competitive position due to improved service delivery, communications, speed to market, and new growth potential (Battisti et al., 2019). With the help of this literature analysis, we believe there is a link between big data analytics and business agility, as well as the variables sense, seize, and respond.

5.3.2 Objective 2: To review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi.

Because agility is prevalent in many industries, a comprehensive model to measure it is required to identify an enterprise's response to external turbulences (Somanath et al., 2013). Drawing from the various concepts and frameworks developed (Sherehiy et al., 2007; Yauch, 2011; Somanath et al., 2013), this study has adopted characteristics or attributes of agility that may be used to measure agility in a real estate firm in Kenya from the comprehensive agility measurement tool (CAMT) together with an operationalized Dynamic capabilities model. Despite using a mathematical model, CAMT is very subjective because the administrator chose the 10 important criteria among the 41 agility enablers Kuruppalil identified (Kuruppalil, 2018). This CAMT uses the AHP (Analytic Hierarchy Process) method, which introduces the aspect of bias. The AHP's statements are flawed, and this system bases a person's rating on their personal affairs. i.e., mastery of the Decision Maker. Hence in this research we categorized the ten factors according to the operationalized dynamic capabilities theory in order to establish the business agility variable that the factor addresses and thus can assist in identifying specific areas of improvement for organizations to address in order to achieve business agility. It is obvious that there is no one dynamic capability. DCs have been attempted to categorize as internal and external resource reconfigurations, learning and strategic decision-making, restructuring and post-acquisition integration processes, R&D processes, product development processes, and market reaction (Madsen, 2010). Each of the four general categories may be thought of as a set of consistent concepts represented by a single scale. The measuring scale is then fine-tuned to bring the sub-dimensions identified for three of the generic kinds together (Sense, Respond and Transform). The four general kinds can be thought of as broad categories with several sub-dimensions.

Carefully running the regression analysis without independent variables with a p-value greater than 0.05 from the full model and carefully adding those that are close to the 0.05 mark without interfering with the generated p-value derived the proposed metrics. Despite Routines to reconfigure the firms resources in new ways, Customer input in research & development, Real estate product diversity and profit increase having higher p values in the previous conducted regression analysis, addition of the four agility measurement items did not have a significant impact on the p-values as shown in the table below. The p-values maintained values less than 0.05 thus implying that they can be used to test the business agility of a real estate firm in Kenya. Therefore based on the study conducted, the below table represents the key agility measurement items for evaluating business agility in a real estate firm. The method below was

presented in a questionnaire and assessed using a 5-point Likert sca27le and used as a business agility evaluation model.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.052	.163		6.438	<.001
	Technology adoptions	.110	.018	.460	6.124	<.001
	Creatives Identify New Business Opportunities	.139	.024	.395	5.838	<.001
	No of Training/Skill Development Programs	.090	.017	.380	5.155	<.001
	Routines to reconfigure the firms resources in new ways	.069	.019	.246	3.687	<.001
	Customer Input in Research and Development	.070	.018	.260	3.815	<.001
	RE product Diversity	.064	.020	.219	3.139	.004
	Profit Increase from Past Year	.086	.028	.221	3.095	.004

Table 25 : Coefficient table- Results for the proposed business agility evaluation model

5.3.3 Objective 3: To evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi.

Majority of the respondents (58%) indicated that they frequently use big data analytics tools within their job description. The study pool of the respondents was composed of IT administrators, human resource analysts, managers, project managers, investors, business development analysts, sales representatives, brand and marketing specialists, finance consultants, legal associates, IT associates, and sales and marketing executives. Interestingly, no respondents claimed to not utilize big data analytics tools within their job description. Big data analytics is imperative to most real estate economies, aiding in simplifying work-related schedules and meeting customer demands effectively (Ali & Siniak, 2020). The responses indicate that within the Kenyan real estate sector, big data analytics tool are recognized as part of the day-to-day operations of different real estate firms. Therefore, big data analytics can be used to enhance business agility in the real estate market by analyzing significant data that aids in gaining competitive advantage (Ali & Siniak, 2020). Thus, big data analytics is essential in analyzing unstructured, semi-structured, and structured data from various sources in distinct capacities such as terabytes, gigabytes, and zettabytes.

The results of this research indicate that demographic surveys, customer satisfaction data, Real estate Market Information and reports, Real estate Financial transactions, Telephone conversations and Social media and online surveys are data sources that are used in real estate

firms in kenya to a great extent with a median of 4. Consequently, the sources present enormous data to the organization that can only be analyzed through analytics tools. The big data technique aids in providing alternative options during analysis that is significant in achieving the real estate firms' goals and attracting and retaining loyal consumers.

According to the results of this research, the use of big data analytics in real estate firms has had a positive influence on the business agility variables which are sensing capabilities, seizing capabilities and transformation capabilities. The results indicate that use of big data analytics has enhanced the search for new business concepts within the real estate sector, it has increased competitive advantage of the firms and also increased the understanding of customer needs; which constitute the sensing capabilities of business agility. Analysis on the impact of use of big data analytics on the seizing capabilities indicate an average mean value of 3.764 meaning they have influenced seizing capabilities to a great extent. Use of big data analytics has resulted in increased percentage of real estate projects delivered on time, improved number of technology adoptions, improved decision making, real estate product diversity within the organization and an improvement in accurate property evaluations. With an average mean value of 3.464, the research study indicates that the use of big data analytics positively influences the transforming capabilities of business agility. The use of big data analytics has resulted in the reduction in percentage of attrition of employees, increased profit , increased number of training and skill development programs, improved risk management and an increase in the number of successful continuous improvement projects undertaken in your organization. The results of this study also indicate a positive correlation between use of big data analytics and sensing, seizing and transformation capabilities, which are variables of business agility. The data regressed indicates that the use of big data analytics has an influence on business agility by 62.0% due to an R^2 value of 0.620. The ANOVA results indicate that 25.663 out of 28.750 is explained by the independent variables, while the balance (3.087) is explained by variables outside the study. Sensing capabilities, seizing capabilities and transforming capabilities are likely indicators business agility in a real estate firm in Kenya since the regression coefficient results show p-value are below 0.05, and if $p<0.05$ means we reject the null hypothesis and accept the alternate hypothesis.

The results of the qualitative analysis of this study indicate that big data analytics is an important avenue of enhancing business agility and creating new revenue streams through encouraging product improvement and innovations. Ghasemaghaei et al. (2017) argue that organizations can tap into the benefit of big data in order to correctly align their products with the market needs and become competitive. Therefore, big data provides real estate firms with

unprecedented opportunities to enhance their product line by encouraging innovation, stimulating market demands and enhancing agility (Hassna & Lowry, 2016). Real estate firms are able to benefit from the advantages offered by big data analytical tools in order to correctly match their products to the needs of the market. The ability of firms in the real estate sector to quickly address the changing customer needs and identify the activities of their rivals is a strong source of business agility. Therefore, based on the research data analyzed, is a strong correlation between big data and business agility in real estate firms in Kenya because it enables firms to track the activities of their rivals, products, and collect consumer feedback that greatly informs decision-making and adaptation to market trends.

The changing landscape in the business environment in the Kenyan real estate sector is forcing traditional players in various industries to invent new measures to remain competitive. Business agility is becoming a new frontier of achieving market competitiveness (Ross, 2021). According to the findings of this study, the real estate firms in Nairobi underscore the significance of using big data tools in order to enhance their market agility, allowing them to monitor new trends and patterns in the industry in order to resolve some of the problems such as COVID-19 disruption and illiquidity problems brought about as a result. Respondents from this research asserted that business agility is becoming a necessity in the real estate sector that will allow Kenyan real estate firms to survive the volatile market environment, enhancing competitive advantage that easily counters new threats. The findings of this study has shown that use of big data analytics is a valuable asset to real estate firms because it enhances their capacity to make better decisions and allow them to explore hidden opportunities that can enhance their competitive levels.

5.4 Conclusion:

5.4.1 Objective 1: To investigate the use of technology and data specifically BDA in business agility.

The study concluded that there is a relationship between the use of big data analytics and business agility. This was reflected by the literature review in regards to the influence of use of big data analytics on business agility. Oliveira-Dias et al. (2022) cite a number of studies that demonstrate how developing information and digital technologies—more especially, a group of these technologies that have been extensively embraced by businesses, such Cloud Computing, Big Data, AI, and IoT—have an effect on such tactics (Giannakis & Louis, 2016). Data analytics tools, for example, may help organizations notice market developments and, as a result, improve their reaction time and efficacy; in other words, increase their agility.

5.4.2 Objective 2: To review existing business agility models and develop a suitable model for evaluating agility in real estate firms in Nairobi.

The study concluded that the categorization of the CAMT factors according to the operationalized dynamic capabilities theory in order to establish the business agility variable that the factor addresses can assist in identifying specific areas of improvement for organizations to address in order to achieve business agility. Carefully running the regression analysis without independent variables with a p-value greater than 0.05 from the full model and carefully adding those that are close to the 0.05 mark without interfering with the generated p-value derived the proposed metrics. The study indicates that the key agility measurement items for evaluating business agility in a real estate firm are technology adoptions, use of creatives to identify new business opportunities, the number of trainings or skill development programs, incorporating routines to reconfigure the firms' resources in new ways, incorporation of customer input in research and development, real estate product diversity and profit increase. These variables form the model for evaluating business agility in real estate sector businesses.

5.4.3 Objective 3: To evaluate and analyze influence of use of big data analytics in business agility in real estate firms in Nairobi..

The study concluded that demographic surveys, customer satisfaction data, Real estate Market Information and reports, Real estate financial transactions, Telephone conversations and Social media and online surveys are data sources that are used in real estate firms in Kenya to a great extent. The study also concludes that the use of big data analytics has a positive influence on sensing capabilities, seizing capabilities and transforming capabilities, which are business agility variables according to the operationalized dynamic capabilities. The results indicate that use of big data analytics has enhanced the search for new business concepts within the real estate firms; it has increased competitive advantage of the firms and increased the understanding of customer needs; which constitute the sensing capabilities of business agility. The study also concludes that the use of big data analytics has resulted in the reduction in percentage of attrition of employees, increased profit , increased number of training and skill development programs, improved risk management and an increase in the number of successful continuous improvement projects undertaken in your organization. Moreover, the study also concluded that the use of big data analytics has resulted in increased percentage of real estate projects delivered on time, improved number of technology adoptions, improved decision making, real estate product diversity within the organization and an improvement in accurate property evaluations. This was demonstrated by regression and correlation results, which back

up the findings since there was a positive, significant relationship between the usage of big data analytics and the sensing capabilities, seizing capabilities, transforming capabilities.

Prop-tech, IoT, blockchain, teleconferencing, and land registration, among other technologies, look to be significant in the structure of facility-real estate and asset management, according to study by Wang & Tang (2020). Tools for automated real estate research will make it easier to plan, keep track of, and complete chores related to moving. Thanks to cutting-edge technology, people and the real estate business should be ready for upcoming changes. Smart structures and technologies that allow for less touch in buildings and structures are anticipated to become commonplace in this setting. Cities are observing a decrease in storefronts, an increase in storage space, and a rapidly expanding e-commerce marketing sector. Examples of the shrinking administrative space needed by public and commercial companies, declining office demand, and expanding home office or flexible working phenomena include shrinking firms, greater use of technology, and declining employment. Digitalization is inevitable, both personally and professionally. All industries will be compelled by new regulations to reorganize their real estate and asset management activities, notably banks, insurance companies, private pension funds, and other organizations.

5.5 Limitations of the study

Due to the Covid-19 ramifications, which saw a large number of employees from real estate enterprises laid off, the number of respondents who could participate in the survey was reduced. This constraint was overcome by using a sample size that was representative of the many departments with relevant big data analytics and business agility know-how and expertise. Another potential flaw was the data gathering method, which in this case required a lengthy time for responders to complete the questionnaire instrument. The researcher continued to provide reminders until the tools were completely filled. Covid-19 was also a limitation in that it inhibited movements, and effected the social distancing measures, thus in-person data collection could not be conducted and the researcher had to fully rely on the online tools.

This study was confined to the real estate firms in Nairobi with a key focus on how big data analytics influences business agility from the perspective of use of big data analytics in real estate sector. We acknowledge that business agility is a broad phenomenon that may be influenced by various aspects, therefore, in this research; we have tried to focus on business data analytics. However, there could have been some minor influence of these other aspects since BDA does not happen in a vacuum and the respondents may have a varied perception of business agility and may have offered responses in the perspective of other factors and not solely focusing on big data analytics as the key influence.

5.6 Recommendations

The model recommended for the evaluation of business agility in real estate firms in Nairobi according to this research concluded that the categorization of the CAMT factors according to the operationalized dynamic capabilities theory in order to establish the business agility variable that the factor addresses can assist in identifying specific areas of improvement for organizations to address in order to achieve business agility. Institutions needing to improve business agility need to embrace BDA for execution and measurement of business processes. It is important to identify the variables that define business agility within your organization and constantly measure against the business agility measurement model to determine areas of improvement that may result in improved business, better product delivery and better decision making and increased customer satisfaction. Real estate firms should make good use of big data to harness the potentials, especially when property prices continue to grow or property bubble inflation threatens the national economy and people's lives. The findings of this research provide several implications for managers and decision makers. The study underpins the use and influence of use of big data analytics on the real estate businesses to gain greater agility. Therefore, business managers and decision makers need to encourage the use of big data analytics, which in turn boost up business agility within their organizations.

5.7 Suggestions for further studies

According to Liu et al. (2019), there are two types of big data analytics use: regular BDA and ad hoc BDA. We incorporated the usage of BDA as a single construct in this study and assessed the influence of BDA use on business agility. Because this study did not focus on distinguishing between the two forms of BDA usage, future research should focus on BDA use. We may be able to come up with additional findings concerning the influence of use of big data analytics on business agility if we can partition these two forms of BDA use into two different constructs (i.e., routine use and ad hoc use of BDA). As a result, future study might focus on fine-tuning the assessment items for each BDA application. Future work can also incorporate research on the big data analytics tools used in the real estate sector as well as granular BDA variables that are relevant to the influence in business agility in businesses. More data sources used in the real estate sector can be studied thanks to enhanced technology capable of storing and managing not only structured but also unstructured and multi-structured data, as well as expanded capacity. Studies may be conducted on the most useful data sources and if they are continually increasing the quality of the findings, resulting in increased business agility. This is an important research because it allows firms to determine whether investing in the adoption of a certain data source is worthwhile in the long run and it will improve the reliability of this

study. Finally, firm agility can be influenced by factors other than data analytics use. Hence, the impact of other factors on organization agility warrants future research.

6 REFERENCES

Aghina, W., Handscomb, C., Ludolph, J., Róna, D., & West, D. (2020, October 23). *Enterprise agility: Buzz or business impact?* McKinsey & Company. Retrieved from https://www.mckinsey.com/business-functions/organization/our-insights/enterprise-agility-buzz-or-business-impact

Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment? *International Journal of Production Economics*, *182*, 113–131. Retrieved from https://doi.org/10.1016/j.ijpe.2016.08.018

Ali, B., & Siniak, N. (2020). Integrating Big Data Into Decision-Making In Real Estate Industry. *Journal of Management, Vol. 36*(No. 2), 25–33. Retrieved from https://doi.org/10.38104/vadyba.2020.2.05

Al-Omoush, K. S., Simón-Moya, V., & Sendra-García, J. (2020, October 1). The impact of social capital and collaborative knowledge creation on e-business proactiveness and organizational agility in responding to the COVID-19 crisis. *ScienceDirect*. Retrieved from https://www.sciencedirect.com/science/article/pii/S2444569X2030038X

Alsos, G., Borch, O., Ljunggren, E., & Madsen, E. (2007). THE DYNAMIC CAPABILITY CONSTRUCT AND ITS OPERATIONALIZATION. *ResearchGate*. https://www.researchgate.net/publication/254555473_THE_DYNAMIC_CAPABILITY_CONSTRUCT_AND_ITS_OPERATIONALIZATION

Amadeo, K., & Uradu, L. D. (2021, May). What is real estate? *The Balance*. Retrieved from https://www.thebalance.com/real-estate-what-it-is-and-how-it-works-3305882

Asaftei, G. M., Doshi, S., Means, J., & Sanghvi, A. (2021, March 30). *Getting ahead of the market: How big data is transforming real estate*. McKinsey & Company. Retrieved from https://www.mckinsey.com/industries/real-estate/our-insights/getting-ahead-of-the-market-how-big-data-is-transforming-real-estate

Battisti, E., Shams, S. M. R., Sakka, G., & Miglietta, N. (2019, September 19). *Big data and risk management in business processes: implications for corporate real estate | Emerald Insight*. Emerald Insight. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/BPMJ-03-2019-0125/full/html

Boone, H., N, & Boone, D. A. (2012). Analyzing Likert data. *The Journal of Extension, 50*, 1-5. Retrieved from https://www.semanticscholar.org/paper/Analyzing-Likert-Data.-Boone-Boone/84df2fd8bd96bf28009fb7f8d035dfef63b3b8dd

Botelho, B., & Bigelow, S. J. (2021, May 27). Big data. *SearchDataManagement.* Retrieved from https://searchdatamanagement.techtarget.com/definition/big-data

Bowman, R. J. (2020). Podcast | The impact of the coronavirus on global supply chains, *Supply Chain Brain - Supply Chain News, Analysis, Videos, Podcasts*. Retrieved from https://www.supplychainbrain.com/articles/30969-podcast-the-impact-of-the-coronavirus-on-global-supply-chains

Bright Data LTD. (2022, March 24). *Real estate analytics: How Big Data Is Transforming Real Estate*. Bright Data. https://brightdata.com/blog/leadership/how-big-data-is-transforming-real-estate

Cardeal, N., & Antonio, N. S. (2012). Valuable, rare, inimitable resources and organization (VRIO) resources or valuable, rare, inimitable resources (VRI) capabilities: What leads to competitive advantage? *African Journal of Business Management 6*(37), 10159-10170. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2347978.

Cardeal, N., & Antonio, N. S. (2012). Valuable, rare, inimitable resources and organization (VRIO) resources or valuable, rare, inimitable resources (VRI) capabilities: What leads to competitive advantage? *African Journal of Business Management 6*(37), 10159-10170. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2347978.

Cookie, H., Appel-Meulenbroek, R., & Arentze, T. (2019). Is the much discussed agility of corporate real estate visible in practice? An empirical study of the relationship between business metrics and surplus property. *International Journal of Strategic Property Management*, *23*(4), 227–243. Retrieved from https://doi.org/10.3846/ijspm.2019.8029

Corporate Finance Institute. (2020, April 23). *Real Estate*. Retrieved from https://corporatefinanceinstitute.com/resources/careers/jobs/real-estate/

Couto, E. S. (2015, November 16). *Repositório da Universidade Portucalense: Can IS/IT Governance Contribute for Business Agility?* Portucalense University Repository. Retrieved from http://repositorio.uportu.pt/handle/11328/1311

Couto, E. S. (2015, November 16). *Repositório da Universidade Portucalense: Can IS/IT Governance Contribute for Business Agility?* Portucalense University Repository. Retrieved from http://repositorio.uportu.pt/handle/11328/1311

Creswell, J. (2009). *Research design: Qualitative & quantitative approaches, 2nd edn*. Thousand Oaks: SAGE Publications.

Creswell, J. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4thed.). Upper Saddle River, NJ: Pearson Education.

Creswell, J., W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks: Sage publications.

Cytonn Real Estate (2021). Technology and its impact on the real estate industry. *Cytonn Real Estate*. Retrieved July 2, 2021, from https://cytonnrealestate.com/blog/article/technology-and-its-impact-on-the-real-estate-industry

Cytonn. Impact of COVID-19 on Kenya's real estate sector. (2020, June 7). *Cytonn.* Retrieved from https://www.cytonn.com/topicals/impact-of-covid-19-on-kenyas-real-estate-sector

Dash, S. (2019, June 19). Big data in healthcare: Management, analysis and future prospects. *Journal of Big Data*. Retrieved from https://journalofbigdata.springeropen.com/articles/10.1186/s40537-019-0217-0

"Definition of Big Data - Gartner Information Technology Glossary." (n.d.). Gartner. Retrieved July 1, 2021, from https://www.gartner.com/en/information-technology/glossary/big-data

DeLisle, J. R., Never, B., & Grissom, T. V. (2019). The big data regime shift in real estate. *Journal of Property Investment & Finance*, *38*(4), 363–395. Retrieved from https://doi.org/10.1108/jpif-10-2019-0134

Deloitte. (2013). *The Analytics Advantage We're just getting started*. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Deloitte-Analytics/dttl-analytics-analytics-advantage-report-061913.pdf

Deloitte. (2020, May). *Economic impact of the COVID-19 pandemic on East African economies*. https://www2.deloitte.com/content/dam/Deloitte/tz/Documents/finance/Economic_Impact_Covid-19_Pandemic_on_EastAfrican_Economies.pdf

Dokovic, D. (2019, March 7). Three ways investors can increase agility in uncertain commercial real estate markets. *Forbes.*Retrieved from https://www.forbes.com/sites/forbesrealestatecouncil/2019/03/07/three-ways-investors-can-increase-agility-in-uncertain-commercial-real-estate-markets/?sh=68beec8d7b16

Draugalis, J. R., & Plaza, C. M. (2009). Best Practices for Survey Research Reports Revisited: Implications of Target Population, Probability Sampling, and Response Rate. *American Journal of Pharmaceutical Education*, *73*(8), 142. https://doi.org/10.5688/aj7308142

Drydakis, N. (2022). Artificial Intelligence and Reduced SMEs' Business Risks. A Dynamic Capabilities Analysis During the COVID-19 Pandemic. *Information Systems Frontiers*. https://doi.org/10.1007/s10796-022-10249-6

Du, D., Li, A., &Zhang, L. (2014). Survey on the Applications of Big Data in Chinese real estate enterprise. *Procedia Computer Science*, 30, 24–33. Retrieved from https://doi.org/10.1016/j.procs.2014.05.377

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Luo, Z., Wamba, S. F., & Roubaud, D. (2019). Can big data and predictive analytics improve social and environmental sustainability? *Technological Forecasting and Social Change*, *144*, 534–545. Retrieved from https://doi.org/10.1016/j.techfore.2017.06.020

Erande, A., & Verma, A. (2007). Measuring Agility of Organizations – A Comprehensive Agility Measurement Tool (CAMT). *The 2008 IAJC-IJME International Conference*. https://www.researchgate.net/publication/254423843_Measuring_Agility_of_Organizations_-_A_Comprehensive_Agility_Measurement_Tool_CAMT

Felipe, C.M., Roldan, J.L. and Leal-Rodrıguez, A.L. (2016), "An explanatory and predictive model for organizational agility", *Journal of Business Research, 69*,10, pp. 4624-4631.

Forrester. (2021, March 4). *Forrester's 10 Dimensions Of Business Agility*. Retrieved from https://go.forrester.com/press-newsroom/forresters-10-dimensions-of-business-agility/

Geiger, J., Elshaw, J., & Jacques, D. (2020). Establishing the Foundations to Measure Organizational Agility for Military Organizations. *Systems, 8*(4), 44. https://doi.org/10.3390/systems8040044

Giannakis, M., & Louis, M. (2016). A multi-agent based system with big data processing for enhanced supply chain agility. *Journal of Enterprise Information Management, 29*(5), 706–727. https://doi.org/10.1108/jeim-06-2015-0050

Ghasemaghaei, M., Hassanein, K., & Turel, O. (2017). Increasing firm agility through the use of data analytics: The role of fit. *Decision Support Systems, 101*, 95–105. Retrieved from https://doi.org/10.1016/j.dss.2017.06.004

Gibbs, G. R. (2013). *Analysing qualitative data*. Los Angeles: Sage Publications.

Giniuniene, J. & Jurksiene, L. (2015). Dynamic capabilities, innovation and organizational learning: Interrelations and impact on firm performance. *Procedia-Social and Behavioral Sciences, 213*(1), 985-991. Retrieved from https://www.sciencedirect.com/science/article/pii/S187704281505870X

Gitau, S. W. (2015, September 2). The application of information technology in real estate firms in Kenya. *University of Nairobi Research Archive*. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/90334

Guma, P., K, & Monstadt, J. (2021). Smart city making? The spread of ICT-driven plans and infrastructures in Nairobi, *Urban Geography*, *42*(3), 360-381. DOI: 10.1080/02723638.2020.1715050

Gunasekaran, A., Yusuf, Y. Y., Adeleye, E. O., & Papadopoulos, T. (2017). Agile manufacturing practices: the role of big data and business analytics with multiple case studies. *International Journal of Production Research*, *56*(1–2), 385–397. Retrieved from https://doi.org/10.1080/00207543.2017.1395488

Hair, J. F., Black, W. C., Babin, B. J., & Anerson, R. E. (2010). *Multivariate Data Analysis.* New Jersey.

Hassna, G., & Lowry, P. B. (2016, December). Big data capability, customer agility, and organization performance: A dynamic capability perspective. *JAIS Theory Development Workshop, International Conference on Information Systems (ICIS 2016),* Dublin, The Republic of Ireland.

Horn, J. (2020). Survival strategies: How Earls is pivoting during the pandemic. *Strategy Online Review*. Retrieved from https://strategyonline.ca/2020/04/07/survival-strategies-how-earls-is-pivoting-during-the-pandemic/

IATA Safety Report. (2021). "IATA Safety Report 2020". Casop.Mandelbrotdesigngroup.Com,

Retrieved from https://casop.mandelbrotdesigngroup.com/wp-content/uploads/2021/04/IATA_Safety_Report_2020_Issued_April_2021.pdf.

Institute of Economic affairs, Center for International Private Enterprise, & Owiro, D. (2011). Kenya property markets scorecard: Conditions for small businesses. *Africa Portal.* Retrieved from https://media.africaportal.org/documents/Kenya-Property-Markets-Scorecard1.pdf

International Business Machines. (2014). Performance and capacity implications for big data. *IBM Redbooks*, *1*. Retrieved from http://www.redbooks.ibm.com/redpapers/pdfs/redp5070.pdf

Jadoul, Q., Nascimento, A., Salo, O., & Willi, R. (2021, March 1). *Agility in the time of COVID-19: Changing your operating model in an age of turbulence*. McKinsey & Company. https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/agility-in-the-time-of-covid-19-changing-your-operating-model-in-an-age-of-turbulence

Jara, A. (2022, June 2). *The Big Data Advantage in Real Estate Analysis*. GetSmarter Blog. https://www.getsmarter.com/blog/career-advice/the-big-data-advantage-in-real-estate-analysis/

Joshi, K, Kale, S, Chandel, S, & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology*, *7*(4), 396-403. Retrieved from https://www.researchgate.net/profile/Ankur_Joshi3/publication/276394797_Likert_Scale_Explored_and_Explained/links/55ec7d9708aeb6516268c9f4.pdf.

Karuga, E. (2019). Adoption of big data analytics to drive decision making. *University of Nairobi Research Archive*. Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/107179/Karuga_Adoption%20of%20Big%20Data%20Analytics%20to%20Drive%20Decision%20Making.pdf?sequence=1&isAllowed=y

Kearns, G., & Sabherwal, R. (2006). Strategic alignment between business and information technology: A knowledge-based view of behaviors, outcome, and consequences. *Journal of Management Information Systems*, *23*(3), 129-162. Retrieved from http://www.jstor.org/stable/40398858

Kenya National Bureau of Statistics. (2020, January). Quarterly Gross Domestic Product report. *Kenya Overview*. (2021, March 30). World Bank. Retrieved from https://www.worldbank.org/en/country/kenya/overview

Kshetri, N. (2014). The emerging role of big data in key development issues: Opportunities, challenges, and concerns. *Big Data & Society*, *1*(2), 205395171456422. Retrieved from https://doi.org/10.1177/2053951714564227

Kumar, N. (2013). *Nokia: Channels of distributions.* GRIN Verlag: Munich, Germany.

Kuruppalil, Z. (2018). Measuring Leanness and Agility of Job Shops: A Rating Scale Based on Expert Consensus. *Journal of Business and Management Sciences*, *6*(3), 112–117. https://doi.org/10.12691/jbms-6-3-8

Li, J., Tao, F., Cheng, Y., & Zhao, L. (2015). Big data in product lifecycle management. *The International Journal of Advanced Manufacturing Technology*, *81*(1–4), 667–684. Retrieved from https://doi.org/10.1007/s00170-015-7151-x

Lica, M., D. (2020). Business agility – the key for building innovative solutions in an IT organization. *Proceedings of the 3rd International Conference on Economics and Social Sciences*, 768-776. DOI:10.2478/9788395815072-076

Lin, Y. and Wu, L.Y., (2014). Exploring the role of dynamic capabilities in firm performance under the resource-based view framework. *Journal of Business Research, 67*(3), pp. 407-413. Retrieved from https://doi.org/10.1016/j.jbusres.2012.12.019

Liu, S., Chan, F.T.S., Yang, J. and Niu, B. (2018). "Understanding the effect of cloud computing on organizational agility: an empirical examination", *International Journal of Information Management, 43,* pp. 98-111.

Liu, Q., Hyun, Y., Hosoya, R., & Kamioka, T. (2019). How Big Data Analytics Impacts Agility. *Proceedings of the 2019 7th International Conference on Information Technology: IoT and Smart City*. https://doi.org/10.1145/3377170.3377180

Long, R. G., White C. M., Friedman, W., H. & Brazeal D., V. (2000). The 'Qualitative' versus 'Quantitative' research debate: A question of metaphorical assumptions. *International Journal of Value-based Management, 13*(1), 189-197. Retrieved from https://link.springer.com/article/10.1023/A:1007850027589

Lu, Y. and Ramamurthy, K. (2011). "Understanding the link between information technology capability and organizational agility: an empirical examination", *MIS Quarterly, 35*(4), pp. 931-954.

Madhani, P., M. (2014). Resource Based View (RBV) of competitive advantage: An overview. *Research Gate.* pp. 1-21. Retrieved from https://www.researchgate.net/publication/45072518_Resource_Based_View_RBV_of_Competitive_Advantage_An_Overview?enrichId=rgreq-d1adb8b7fb38873152a5cae8af2a9a09-XXX&enrichSource=Y292ZXJQYWdlOzQ1MDcyNTE4O0FTOjEwMzMwMjQ0NDM1NTU5OEAxNDAxNjQwNjMwNzM4&el=1_x_2&_esc=publicationCoverPdf

Madsen, E. (2010). A dynamic capability framework: Generic types of dynamic capabilities and their relationship to entrepreneurship. *ResearchGate*, 223–243. https://www.researchgate.net/publication/290264399_A_dynamic_capability_framework_Generic_types_of_dynamic_capabilities_and_their_relationship_to_entrepreneurship

Mao, H., Liu, S., Zhang, J., Zhang, Y., & Gong, Y. (2020). Information technology competency and organizational agility: Roles of absorptive capacity and information intensity. *Information Technology & People*, *34*(1), 421–451. Retrieved from https://doi.org/10.1108/itp-12-2018-0560

Marangu, N. (2021, March). Benefits of using big data analytics for inclusive Real Estate. *Management*, *090*. Retrieved from https://kmrc.co.ke/wp-content/uploads/2021/03/MANAGEMENT-MARCH-2021-ISSUE.pdf

Mbaluka, W. (2013, November). Big data management and business value in the commercial banking sector in kenya (Master's dissertation). *University of Nairobi*. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/58632

McKinsey&Company. (2015). *Marketing & sales big data, analytics, and the future of marketing & sales* [E-book].

Meinhardt, R., Junge, S., & Weiss, M. (2018, January 22). The organizational environment with its measures, antecedents, and consequences: A review and research agenda. *Management Review Quarterly*. Retrieved from https://link.springer.com/article/10.1007/s11301-018-0137-7?error=cookies_not_supported&code=43f3bbb4-08e1-49fe-9450-c29de9020e2c

Miller, M., L. (1986). *Reliability and validity in qualitative research qualitative research methods, ISSN 0888-5397 Sage university paper*. Thousand Oaks, CA: SAGE. doi:0888-5397.

Mouthaan N. (2012). Business Information Systems. University of Amsterdam.

Mu, J, Wu, F and Zhang, A, 2014, Housing value forecasting based on machine learning models. *Abstract and Applied Analysis*, 2014, Article ID 648047.

Mugane, G. M. (2019, January 23). Big data analytics and competitive advantage of commercial banks and Fintech companies in Kenya. *University of Nairobi Research Archive*. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/105289

Muiruri, C. W. (2018, December). Critical factors and real estate development by private developers in Kiambu county, Kenya (Thesis). *Kenyatta University.* Retrieved from https://ir-library.ku.ac.ke/bitstream/handle/123456789/19859/Critical%20Factors%20and%20Real%20Estate%E2%80%A6..pdf?sequence=1

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. Retrieved from https://doi.org/10.3390/bdcc4020004

Neil, H., Rose, H., P, & Clark, M. (2009). Using qualitative repertory grid techniques to explore perceptions of business-to-business online customer experience. *Journal of Customer Behaviour, 8*(1), 51-65. doi: 10.1362/147539209x414380.

Newman, S., A, & Ford R., C. (2020). 'Five steps to leading your team in the virtual Covid-19 workplace', *Organizational Dynamics*, pp. 1-11. Retrieved from https://doi.org/10.1016/j.orgdyn.2020.100802.

Nzalu, F. M. (2013). An assessment of the factors affecting the growth in real estate investment in Kenya (Thesis). *University of Nairobi Research Archive*. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/62731

Oliveira-Dias, D., Maqueira-Marín, J. M., & Moyano-Fuentes, J. (2022). The link between information and digital technologies of industry 4.0 and agile supply chain: Mapping current research and establishing new research avenues. *Computers & Industrial Engineering*, *167*, 108000. https://doi.org/10.1016/j.cie.2022.108000

Ouma, A. O. (2020, October 27). Influence of big data analytics on operational agility of selected state entities in Kenya. *University of Nairobi Research Archive*. Retrieved from http://erepository.uonbi.ac.ke/handle/11295/152956

Panda, S., & Rath, S. K. (2016). Investigating the structural linkage between IT capability and organizational agility. *Journal of Enterprise Information Management*, *29*(5), 751–773. https://doi.org/10.1108/jeim-04-2015-0033

Pisano, G. P. (2016). "Towards a prescriptive theory of dynamic capabilities: Connecting strategic choice, learning, and competition." *Harvard Business School Working Paper*, 16-146. Retrieved from http://nrs.harvard.edu/urn-3:HUL.InstRepos:27882661

Puckett, S. (2021, July 10). Agility in the real estate industry. *Insightsoftware.* Retrieved from https://insightsoftware.com/blog/agility-in-the-real-estate-industry/

Quick Real Estate Statistics. (2020, November 11). Www.Nar.Realtor. https://www.nar.realtor/research-and-statistics/quick-real-estate-statistics

Research and Markets. (2020, October). *Kenya real estate market activities report 2020: The government had aimed for 500,000 new affordable homes by the end of 2022*. Retrieved from https://www.researchandmarkets.com/reports/5185323/real-estate-activities-in-kenya-2020#src-pos-1

Roberts, N., & Grover, V. (2012). Leveraging information technology infrastructure to facilitate a firm's customer agility and competitive activity: An empirical investigation. *Journal of Management Information Systems*, *28*(4), 231–270. Retrieved from https://doi.org/10.2753/mis0742-1222280409

Ross, B. (2021, June 17). Real Estate industry challenges & opportunities in 2021. *Linchpin SEO*. Retrieved from https://linchpinseo.com/challenges-facing-the-real-estate-industry/

Ross, J. W., Beath, C. M., & Quaadgras, A. (2013, December). You may not need big data after all. *Harvard Business Review*. Retrieved from https://hbr.org/2013/12/you-may-not-need-big-data-after-all

Sáez P. L., López J. E. N., de Castro G.M., & González J. C. (2013). The knowledge-based theory of the firm and the question of firm boundaries. In: von Krogh G., Takeuchi H., Kase K., Cantón C.G. (eds). *Towards Organizational Knowledge. The Nonaka Series on Knowledge and Innovation.* Palgrave Macmillan, London. https://doi.org/10.1057/9781137024961_8

Saunders, M., Lewis, P., & Thornhill, A. (2009). Understanding research philosophies and approaches. *Research methods for business students*, *4*(2), 106-135.

Shuen, A. (2008). Web 2.0: A strategy guide: Business thinking and strategies behind successful Web 2.0 implementations. Sebastopol, CA: O'Reilly Media, Inc.

Social Pillar | Kenya Vision 2030. (2021). Kenya Vision 2030. Retrieved July 2, 2021, from https://vision2030.go.ke/social-pillar/#68

Sun, D, Du, Y, Xu, W, Zuo, M, Zhang, C & Zhou, J, (2014) Combining online news articles and web search to predict the fluctuation of real estate market in big data context. *Pacific Asia*

Journal of the Association for Information Systems, 6(4), pp. 19-37

Sveiby, K. (2001). A knowledge-based theory of the firm to guide in strategy formulation. *Journal of Intellectual Capital, 2*(4), 344-358. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/14691930110409651/full/html

Tanrıvermiş, H. (2020). Possible impacts of COVID-19 outbreak on real estate sector and possible changes to adopt: A situation analysis and general assessment on Turkish perspective. *Journal of Urban Management*, *9*(3), 263–269. https://doi.org/10.1016/j.jum.2020.08.005

The Global Risks Report 2021. (2021, January 19). World Economic Forum. https://www.weforum.org/reports/the-global-risks-report-2021/

Ullah, F., Sepasgozar, S. M. E., & Siddiqui, S. Q. (2017). An investigation of real estate technology utilization in technologically advanced marketplace. *9th International International Civil Engineering Congress (ICEC-2017).*

Veseling, B. (2021, August 11). *How Kenya's Standard Group transformed their business during COVID-19*. WAN-IFRA. https://wan-ifra.org/2021/08/how-kenyas-standard-group-transformed-their-business-during-covid-19/

Walter, A. (2020, April 19). Organizational agility: Ill-defined and somewhat confusing? A systematic literature review and conceptualization. *Management Review Quarterly*. Retrieved from https://link.springer.com/article/10.1007/s11301-020-00186-6?error=cookies_not_supported&code=b5951b90-4c20-4fd6-9386-5e8eac387c6d

Wamba, S. F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics, 165*, 234–246. Retrieved from https://doi.org/10.1016/j.ijpe.2014.12.031

Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J. F., Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research, 70*, 356–365. Retrieved from https://doi.org/10.1016/j.jbusres.2016.08.009

Wang, G., Gunasekaran, A., Ngai, E. W., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *International Journal of Production Economics, 176*, 98–110. Retrieved from https://doi.org/10.1016/j.ijpe.2016.03.014

Wang, H. L. (2014). Theories for competitive advantage. In H. Hasan (Eds.), Being practical with theory: A window into business research (pp. 33-43). Wollongong, Australia: THEORI. Retrieved from http://eurekaconnection.files.wordpress.com/2014/02/p-33-43-theories-of-competitive-advantage-theori-ebook_finaljan2014-v3.pdf

What is big data analytics? (2021). IBM. Retrieved July 29, 2021, from https://www.ibm.com/analytics/hadoop/big-data-analytics

Wheeler, B., C. (2002). NeBIC: A dynamic capabilities theory for assessing Net-enablement. *Information Systems Research,* 13(2), 125-146. Retrieved from https://www.jstor.org/stable/23011051

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

Wu, J & Deng, Y. (2015). Intercity information diffusion and price discovery in housing markets: Evidence from Google searches. *Journal of Real Estate Finance and Economics, 50*, pp. 289-306.

Zhang, L. (2014). Survey on the applications of big data in chinese real estate enterprise. *Procedia Computer Science, 30*, 24–33. https://doi.org/10.1016/j.procs.2014.05.377

7 APPENDIX 1: CONSENT FORM

RIGHTS OF RESEARCH SUBJECTS

Kindly note that you can withdraw your research participation at any moment without any form of consequences. This research advocates and honor willing participation and will adhere to the ethical consideration that some of you want to preserve your anonymity/privacy throughout this entire research undertaking. Please understand that all privileges and rights that are accorded to you will honor privacy and confidentiality protocols for those who wish to only offer answers to research questions, devoid of disclosing any other personal information.

LEGAL REPRESENTATIVE AND/OR SIGNATURE OF RESEARCH SUBJECT

I hereby declare and affirm that I comprehend all the terms/conditions required to conduct this research undertaking and that all the questions have been answered. I agree to be involved in this research process voluntarily.

Name of Research Participant/Respondent

_____

Name of Legal Member/Any Representative (if applicable)

_____

8 APPENDIX 2: RESEARCH QUESTIONNAIRE

A. Personal Data

a) Name (optional):

---

b) Organization:

---

c) Age
   - Below 25
   - 25-35
   - 36-45
   - 46-65
   - 66-75
   - Above 75 years

d) Sex
   - Male
   - Female

e) Job Title / Occupation

B. Research Question 2:

1. Sector of Real Estate Economy
   - Public Sector
   - Private Sector
2. Which category does your organization fit in within the real estate spectrum? (Select all relevant categories)
   a) Development
   b) Sales and marketing
   c) Brokerage
   d) Investments
   e) Property management
   f) Lending
   g) Professional Services (Law, Accounting etc)
   h) Other: (Indicate below)

   ---

3. How many employees does your organization have?
   - Less than 50
   - 51-100
   - 100-500
   - 500-1000
   - Over 1000

4. Would you consider your organization agile?
   a) Yes
   b) No

5. Does your organization systematically search for new business concepts through observation of processes in the environment?
   a) Yes
   b) No

6. Does your organization systematically benchmark the firm with the best in the industry?
   a) Yes
   b) No

   If yes, how often does this happen?
   - Very Frequently
   - Frequently
   - Occasionally
   - Rarely
   - Never

7. What is the percentage of work balanced at or slightly below the official project delivery time?

Score	1	2	3	4	5
%	0-20	20-40	40-60	60-80	80-100

8. What are the number of technology adoptions done for the past 5 years?

1	2	3	4	5
01	02	03	04	05 or more

9. What are the number of real estate critical problems faced by your organization and solved in past 1 year?

1	2	3	4	5
01-03	04-06	07-08	09-10	more than 10

Outline the real estate critical problems:

i. ----------
ii. ----------
iii. ----------
iv. ----------
v. ----------

10. Our organization systematically brings together creative and knowledgeable persons within the firm to identify new business opportunities.

- Strongly Agree
- Agree
- Undecided
- Disagree
- Strongly Disagree

11. In your opinion, what is the Internal customer satisfaction index on the scale of 1-5; 1 being unsatisfied?

1	2	3	4	5
01	02	03	04	05

12. % of Attrition for Employees with Experience Less than 2 Years

Score	1	2	3	4	5
%	>20	20-15	15-10	10-05	05-0

13. % of Attrition for Employees with Experience More than 2 Years

Score	1	2	3	4	5
%	>10	10-08	08-06	06-04	04-02

14. In your opinion, what is the percentage of real estate product diversity within the organization?

1	2	3	4	5
0-20	20-40	40-60	60-80	80-100

15. Compared to our competitors, our organization cooperate more closely with our customers about innovation and Research & Development
    - Strongly Agree
    - Agree
    - Undecided
    - Disagree
    - Strongly Disagree

16. Employees contribute with new product/service ideas to a larger extent than those of our competitors.
    - Strongly Agree
    - Agree
    - Undecided
    - Disagree
    - Strongly Disagree

17. The organization’s management is involved in the real estate research and development process.
    - Strongly Agree
    - Agree
    - Undecided
    - Disagree

- Strongly Disagree

18. What is the number of Training / Skill Development Programs Completed within your organization?

Score	1	2	3	4	5
%	0-30	30-50	50-80	above 80	100

19. Our organization has set up routines to reconfigure the firm's resources in new ways i.e. Realigning assets and redesigning business models.
    - Strongly Agree
    - Agree
    - Undecided
    - Disagree
    - Strongly Disagree

20. What is your organization's % of Profit Increase from Past Year

Score	1	2	3	4	5
%	0-20	20-40	40-60	60-80	80-100

C. Research Question 3:

21. Do you use big data analytics tools within your job description?
    - Very Frequently
    - Frequently
    - Occasionally
    - Rarely
    - Never

22. To what extent are the below data sources utilized in Big data analytics in your organization

	No extent at all	Little extent	Moderate extent	Great extent	Very great extent
Demographic surveys					
Customer satisfaction data					
Real estate Market Information and reports					
Real estate Financial transactions					
Telephone conversations					
Social media and online surveys					
Other (Please Indicate)					

23. Has big data analytics positively influenced your organization?
    a) Yes
    b) No

Explain

---

24. To what extent has big data analytics helped your organization to achieve the following business agility indicators benefits below?

Business Agility sensing capabilities	No extent at all	Little extent	Moderate extent	Great extent	Very great extent
The use of Big data analytics has Enhanced the search for new business concepts					
The use of Big data analytics has Increased competitive advantage					
The use of Big data analytics has increased the understanding of customer needs better					

Business Agility seizing capabilities	No extent at all	Little extent	Moderate extent	Great extent	Very great extent
The use of Big data analytics has resulted in increased percentage of real estate projects delivered on time					
The use of Big data analytics has resulted in improved number of technology adoptions done					
The use of Big data analytics has resulted in Improve decision-making					
The use of Big data analytics has resulted in Real estate product diversity within the organization					
The use of Big data analytics has resulted in Improved accurate property evaluations					

Business Agility transforming capabilities	No extent at all	Little extent	Moderate extent	Great extent	Very great extent
The use of Big data analytics has resulted in reduced percentage of Attrition for Employees					

The use of Big data analytics has resulted in increased of Profits from Past Year					
The use of Big data analytics has resulted in increased the Number of Training Skill Development Programs					
The use of Big data analytics has resulted in improved risk management					
The use of Big data analytics has resulted in increase in the number of successful continuous improvement projects undertaken in your organization.					
Other (Please Indicate)					

25. Has real-time data optimization and visualization (big data analytics) had an effect on your organization's agility and growth of real estate within your working capacity?

Explain why or why not?
