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CHALLENGES AFFECTING ADOPTION OF BIG DATA ANALYTICS IN TELECOMMUNICATION FIRMS IN KENYA

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DECLARATION

This research project is my original work and has not been presented for a degree in any other University

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ABSTRACT

Big data analytics is a crucial concept that has made companies to obtain an edge by collecting and making sense of data in regard to their customers, products as well as other critical details. These companies generate so much information and data that if well analysed would provide a strategic direction and the company will be in position to understand its critical role in the market. Information is vital for upholding strategies and trading becomes more impactful with the right market information. It is therefore in the interest of companies as well as corporations to ensure that they invest adequately and improve their technological capacities and competence in making sense of data they collect. The study therefore undertook to determine the challenges that affect adoption of big data analytics in Telecommunication firms in Kenya. The study therefore undertook a descriptive research design, as well as a correlational design to correlate the challenges with adoption of BDA. The study relied on primary data where data was collected from managers in these firms. Structured questionnaires were sent to the study respondents and both correlational analysis together with regression analysis were undertaken by the study. The study findings were very relevant and quite informative in relation to the study. The challenges that influence adoption of data analytics in Telecommunication firms in Kenya insinuates that Technological challenges, data challenges, managerial challenges and process challenges are critical factors in influencing adoption of BDA. The respondents pointed those technological challenges such as hardware and software were issues of concern as they indicated that respective firms had inadequate hardware and software that could not suffice in adoption of BDA. Similarly, internet connectivity was not well enhanced and was a factor that contributed to technological challenges. With enhanced and a more emphasis on technological challenges faced by Telecommunication firms in Kenya, then there would be

increased use and adoption of BDA. The correlation of adoption of BDA with technological challenges was significant and very strong at 0.736 and therefore indicating that it is a real and vital challenge that ought to be addressed. Priority should therefore be enhanced on addressing technological challenges to enhance adoption of BDA. Data challenges were also found to have significant correlation with adoption of big data analytics at Pearson's rho of 0.558. Managerial challenges were also found to be very critical in enhancing adoption of BDA. The correlational analysis of the study was found to be significant, but it was relatively weak at 0.314. It therefore denotes that despite the fact that having competent managers as well as managers who are willing to inculcate BDA into the culture of the firm, the firms have performed well in addressing this challenge. The study found that process challenges were significant and affected adoption of BDA. The correlation analysis had a Pearson's rho of 0.539 which was significant. The study recommends that Telecommunication firms should invest more in infrastructure and data security and privacy. The government should make laws for enhancing private data handling and privacy issues to be upheld.

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ABBREVIATIONS

ARCC	Africa Regional Center for Computing
BDA	Big Data Analytics
BDAC	Big Data Analytics Capability
CAK	Communications Authority of Kenya
IDC	International Data Corporation
IGO	Intergovernmental Organizations
IoT	Internet of Things
KICA	Kenya Information and Communications Act
UBA	United Bank of Africa
VOIP	Voice Over Internet Protocol

ACRONYMS

CCK	Communications Commission of Kenya
IBM	International Business Machines Corporation
IT	Information Technology
NGO	Non-government Organization

DEFINITION OF TERMS

Information Technology refers to the acquisition or the management of information through the use of computer-based tools. This is undertaken through acquisition, storing, processing and its distribution (Mirani & Lederer, 2008).

Big Data Refers to extraction of useful value additive information from data through either predictive analytics, advanced data analytics methods or through user behaviour analytics (Fosso et al., 2015b; Wixom et al., 2013).

Business Analytics is the transformation of massive quantities of raw data into useful data for the purpose of analysing it using different tools and methodologies (Letouze, 2012).

Big Data Analytics refer to the process in which information is extracted from data sets that are too large or complex and which traditionally data processing applications may not be in position to handle (Arthur, 2013).

Internet Connectivity It refers to the way people get accustomed and dependent on internet, either through their phones, networks always-on broadband connections. Internet connectivity may also refer to the ability of individuals and organizations obtaining internet access and therefore able to connect to the internet using computer terminals as well as other devices that are capable of internet connectivity (Mirani & Lederer, 2008).

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

In the current world, technology has advanced to a point that it is easier and fast to generate data through phone and the advent of internet. It is estimated that the amount of data generated has risen to 40 Exabyte (Matthias, Fourweather & Gregory, 20I7). There has been increased innovativeness in technology as a result of worldwide improved affordability of digital services and therefore heralded the age of big data. The data revolution is no longer limited to the developed countries (VIicheni, 2015). Organizations are realizing the wealth that can be generated by getting value out of data that passes through their hands every second. In the current world, successful companies are hedging on use of advanced technology, to get the gist of current customer needs as well as accurate prediction of future needs (Marshall, Mueck, & Shoekley, 2015).

Big data is the voluminous data that may either have structural framework, or unstructured framework, which inundates a business on daily basis. The huge volume of data grows exponentially with time in a manner that traditional data management tools may not be able to handle it or process it efficiently since it is too large with so much complexity (Kaisler et al, 2013). Businesses may find processed data to be quite valuable as it may provide critical information regarding their businesses. It may provide the direction these businesses intend to take towards innovations, competitiveness, it may also give information regarding the changing needs of the customers, the customer purchase patterns, among others. It therefore, becomes vital for businesses to process their unstructured and semi-structured big data to obtain value from it and enhance their competitiveness (Issah, 2015).

The increased growth of internet and technology has enabled daily production of big data by Telecommunication companies. Internet user's increase by the day as growth in smartphone industry has enhanced the way users are able to access network on the move. Communications firms in Kenya have undertaken internet connectivity to their clients based on different specific strategies unique to each communications firm. The feedback each company obtains from the market is vital in informing the next strategy which helps each company obtain competitiveness. This means that the big data collected by these companies should be properly analysed and processed to ensure that it provides a clear direction that the company should take (Kariuki & Kagiri, 2018).

Comuzzi and Patel (2016) further say, up to 50% of big data related projects are never completed due to the new technology involved, shortage of relevant skills and high-cost implication among others. In middle class countries like Kenya, adoption of big data analytics faces challenges such as scarcity and skilled human resource and privacy fears which are deepened by the extended structural shortages in infrastructure, economic resources and institutions (Hilbert, 2016).

The advantages of using BDA (big data analytics) have been cited as making better decisions, enhanced data security, operational efficiency as well as improved presentation of information to well capture more insight into the data (Richey, Morgan, LindseyHall, & Adams. 2016). Exploitation of data has prospects of value chain optimization, efficient use of human resource and better customer relationships. Hedging on BDA helps organizations in enhancing operational efficiency as relevant information is provided in time for making crucial decisions and also makes it possible to automate decision making. There is a collective agreement that big data will benefit organizations of all types and sizes (Matthias, Fourweather, & Gregory, 2017).

1.1.1 Big Data Analytics

Big data analytics refer to the process in which information is extracted from data sets that are too large or complex and which traditionally data processing applications may not be in position to handle. Arthur (2013) argues that big data analytics as the analysis of data that is collected from either digital or traditional sources and either within or outside an organization and which may be used by way of analysis to draw insights about the organization. The data may come from different sources that may include, social media, web, behaviour, day to day business transactions, remote sensors, audio and video. Analysts and researchers in an organization are therefore able to make fact-based decisions which are based on processed information that was previously unstructured or semi structured and which could not make sense. The use of predictive analysis, text analytics, machine learning as well as natural language processing may be used in data analytics in processing data to useful information (IBM, 2018). Data driven decisions are valuable to an organization as they help in mitigating against risks that are occasioned through the use of intuition or the gut feeling in making business decisions that would perhaps be very expensive for the organization.

Big data describes data that is characterized by high volume, high velocity, variety, veracity and value requiring new tools for its management (Nwanga, Onwuka, Aibinu, & Obadike, 2015). There are different sources of generating big data in an organization, these sources include online transactions, company emails, digital calls, social media views, logs, search queries, demographical information, likes, dislikes, click streams, science data and mobile phone applications (Sagiroglu & Sinanc, 2013). Micheni (2015) describes BDA as quantitative research that is designed to look into large quantity of data with the goal of identifying patterns, correlations and valuable information. Comuzzi and Patel (2016) posit that the defining feature of big data is the unsuitability of traditional data storage and processing tools to handle it. The most effective big data solutions start with identification of business requirements then

customization of infrastructure, data source and analytics to optimize on opportunities (Fox, Dam, & Shoekley, 2013). Some of the tools used to analyze big data include. Hive, Hbase. Spark, High Performance Custer Computing. No SQL databases and Hadoop and its ecosystem (Arora & Malik, 2015). A key impact of big data is on decision making processes. The capability of processing vast amount of data in a short time enables an organization to make informed decisions fast hence gaining a competitive edge (Comuzzi & Patel, 2016).

According to Akter et al. (2016) 87% of companies believe that big data analytics would help them in enhancing their competitiveness and therefore obtain an edge against their rivals. Experts believe that 89% of the companies that would not accept and actively use big data analytics in their strategic decision-making capacity would lose market share and momentum. However, the investment that goes into big data analytics runs in thousands of dollars for most companies. Undertaking big data analytics costs an arm and leg since modern applications and systems would need to be deployed. It therefore means that obtaining the necessary hardware and software to undertake successful big data analytics is not a walk in the park. Organizations that are not able to plan well for big data analytics may not be able to achieve the expected outcome and the quality of the decisions they undertake may be compromised. It would therefore require deliberate planning as well as budgeting for the process to derive value from the process (Akter et al., 2016).

Three key factors have been observed to generate value as far as data analytics is concerned in any organisation. These factors may also be used to determine the level at which a particular organization is likely to derive value from big data analytics. The first factor is the robustness of IT infrastructure, where it can enhance the efficiency of the organization on one hand and also ensure cost savings techniques are employed as well as enhancing security. The use of big data analytics should support the creation together with imposition of well-designed infrastructure through provision of adequate tools to experts that would the organization stay

at the top of everything. IT can leverage analytics by enhancing network performance in form of traffic, speed, uptime and downtime, as well as user habits. The network analytics is automated, and it is compared against the manner in which the network should be performing. If therefore during analysis it indicates that there is a deviation from the optimal level, the information given to relevant technological team helps them understand what ails the system and network as well as possible solutions to remedy the situation (Buluswar et al., 2016). The other component is cybersecurity where ordinarily, there has been no way of anticipating accurately when a cyberattack issue would occur, but according to International Data Corporation (IDC), proper use of BDA will provide necessary trends and ways of preventing and dealing with such attacks. The other major component of big data analytics is marketing as it is used to determine the best form of advertisement that would create maximum effect. It helps companies in the segmentation of their markets and therefore address issues in designing their products and driving value to their clients which increases their competitiveness. The third major component is employees where analytics have been used by companies to determine what works best for customers and what the organisation should put in place to ensure that the productivity of each employee has been optimised (Impact, 2021).

1.1.2 Big Data Analytics Challenges

Despite the avalanche of benefits from big data, challenges are rampant and should be addressed amicably for an organization to derive the required value from BDA. The methods for undertaking BDA remain a challenge as they may seem complex and not easily deciphered. The models and methods that are used in data processing have limitations and prone to provide erroneous reports, if not well interpreted or steps and procedures are not keenly followed (Jin, et al., 2015). There are distinct studies that have identified potential difficulties in interpretation of big data (Hargittai, 2015), the difficulties are also extrapolated to the decisions made on the kind of data to be collected and generated thereof (Crawford, 2013), there are also issues on

privacy (Lazer et al., 2009) coupled with ethical considerations that are needed in the process of mining such data (Boyd & Crawford, 2012). Tole (2013) accurately asserts that providing working solutions on acquiring and processing big data is a real challenge that businesses must be able to topple upon, as they disembark on getting new approaches of dealing with these challenges. One of the major challenge in big data is lack of proper infrastructure while where they become available, they are very expensive (Wang & Wiebe, 2014). Despite presence of cloud computing technologies, obtaining relevant hardware is very costly.

It is also imperative to ensure that the human interaction with the system that is required to facilitate processing of big data into valuable information that can be interpretated to add value in company processes, is well skilled. However, it becomes such a challenge to get the relevant skilled personnel, and the kind of talent that will decipher the information and collaborate with others up in the value chain. Akerkar (2014) and Zicari (2014) group big data challenges into three categories depending on data life cycle. The first challenge revolves around obtaining accurate data and data characteristics such as variety, velocity, veracity, quality and dogmatism of data, which they called data challenge. Then after overcoming the data challenge, then process challenge sets in. The challenge relates to how techniques as it revolves on the manner of capturing, integration, transformation of data as well as selection of the right model for analysis and presentation of final results. The last category was management challenge, where issues such as data privacy becomes a concern. Other data management issues involve data security, governance as well as observing ethical aspects.

1.1.3 Telecommunication Firms in Kenya

The telecommunications sector in Kenya has experienced rapid growth since 1999. The sector was first recognized through Telecommunications and Postal Sector Policy Statement of February 1997 and legislation of these practices consolidated the sector through the enactment of Kenya Information and Communications Act (KICA) in 1998. The Act was crucial in

identifying the important role played by information and communication sector in the entire economic sector in the country. Reviews to the policy statement were undertaken in the year 2001 as well as 2006. The new developments in the technological arena, innovations and global interconnectivity necessitated amendments to the Act as its operationalization is aligned to technological developments in the country as well as to the impact in the society. These amendments relate to tariffs imposed on products, fair competition policy, consumer protection among others. Most of the development include increased connectivity as a result of improved technical capacities around payphones, paging services, enhanced mobile phone services and use of varied networks as well as use of Internet Service Providers (ISPs) (Mureithi, 2016).

There were only 4 licensed mobile phone service providers in Kenya. They included Safaricom, Airtel, Econet Wireless and Telkom Kenya (The only public fixed-network operator). Econet was however bought out by Airtel Kenya. The liberalisation in the telecommunication industry marshalled and enhanced mushrooming of service providers Including ISPs (Internet Service Providers) and cyber cafes. It is during this time that over 80 towns in Kenya were installed with cellular phone service network. There was also the opportunity for cheaper and more efficient communication channels such as use of E-mail as well as Voice Over Internet Protocol (VOIP), which was an improvement from telex, telegraph and bureau fax services (Christensen, 2001).

The Kenyan telecommunication industry is pegged on the provision of telephony services, provision of internet broadband and the infrastructure that supports all these services. This can therefore be categorized as telephony, internet, fibre-optic, undersea cables and the internet of things (IoT). The Kenya telecommunications sector experienced increased growth in 2018 which was clearly supported by the use of digital economy, affordable mobile telephony, as well as increased internet penetration. Internet access in the country is majorly by increased use and availability of affordable smart phones in the country. Statistics indicate that

subscriptions in terms of data improved to 46.8 million, where almost half of these subscriptions were on broadband. The 19 companies in the industry have Safaricom being the market leader with the greatest mobile and internet subscriptions. The other major players in the industry are Telkom Kenya, Airtel Networks, Finserve Africa and Mobile Pay. The country prides itself with the best use of mobile money transfer, as 58% of its population is believed to be subscribed to mobile money. Figures from the year 2019 indicates that active mobile money transfer subscriptions stood as 32 million with a total of 223,084 mobile money agents (Wood, 2019).

The telecommunication sector in Kenya has contributed greatly towards economic development. The sector has facilitated the provision of mobile financial services, M - education, M-agriculture and others. The upsurge in internet usage brings in novel ways of communicating, learning, and socializing and generally has transformed all aspects of daily life. The Communication Authority of Kenya's Second Quarter Sector Statistics Report F Y 2016-17 reports on the performance of mobile telephone service providers with the key players being Safariconi Limited, Airtel Networks Kenya, Telkom Kenya Limited and Finserve Africa. The number of mobile subscriptions in Kenya is 38 million. Safaricom Limited has a market share of 71.2 %, Airtel has 17.6 %, Telkom Kenya 7.4 % and Finserve Africa has 3.8% (Communication Authority of Kenya, 2017). On the money transfer platform, there are 31.9 million mobile money transfer subscriptions of which Safaricom Limited holds 21.6 million subscribers, Airtel Networks has 6.7 subscribers. Finserve Africa has 1.2 million and Telkom Kenya Limited has 0.2 million. Safaricom Limited claims 80.6%) of the voice traffic, and 67.5% of the mobile data market. Airtel Networks holds 13.5%o of the voice traffic and 19.7% of mobile data while Telkom Kenya has 5.4% of the voice market and 7.1% of the mobile data and Finserve Africa has 0.4% voice traffic and 5.6% of the mobile data market

(Communication Authority of Kenya, 2017). Competition is rife in the industry and the advancement in technology calls for dynamism to survive.

Big data analytics offers opportunities for telecommunication operators to optimize on their operations, better serve customers and be more innovative (Acker, Blockus, & Potscher, 2013). Telecommunication firms can use information about customer usage patterns and other demographics to develop customized products to better meet customer needs hence reducing chum(Arora & Malik, 2015). Nwanga et al (2015) say that the key benefits of big data analytics to telecommunication firms include, optimization of routing and improved quality of service, identification of fraudulent behavior, empowerment of call center staff, targeted marketing campaigns and innovative product development which all add up to improved revenues. Telecommunication companies can use information on customer usage or service plans to develop and offer customized packages suitable for each user hence getting maximum return on their marketing expenditure (Arora & Malik, 2015)

1.2 Problem Statement

Telecommunication operators face a major challenge of keeping their customers happy and reducing churn rates. By using big data analytics, telecommunication firms can gain insight on customer usage patterns and other demographics to develop customized products to better meet customer needs hence reduce chum (Arora & Malik, 2015). The exploitation of big data has good prospects of adding value to a range of operations including value chain, more efficient use of human resource and better customer relationship (Matthias, Fourweather, & Gregory, 2017). Competent firms like Google and Facebook make decisions on products based on what data says about consumer behaviors (Acker, Blockus, & Potscher, 2013).

A study by Richey et al. (2016) citing implication of big data on SCM and logistics established success factors of big data use to be among others, better decision making and operation

efficiency. The findings of Matthias et al (2017) indicate that in using big data the prospects of unraveling previously unavailable insight for sustainable performance are high. Nwanga et al (2015) on BDA and customer service and bottom line of mobile network industries concluded that BDA availed opportunities for the telecom industry to grow and develop since it gave insight on customer satisfaction. Micheni (2015) confirmed the increased uptake of big data analytics and highlighted the need for information dissemination, development of legal frameworks and investment in skills. Ochieng (2015) on the adoption big data analytics reported the challenges faced to be data security, privacy laws and skill gap.

Compared to developed countries, Kenya is still behind in the adoption of information technology. More and more firms are deploying big data analytics and hence there is need for wider information dissemination on big data analytics. Little is written on performance after adoption of big data analytics hence need for further advancement in holistic view of big data analytics (Chen, Preston, & Morgan, 2015). There, is need for all stakeholders to come together and undertake research initiatives aimed at fast tracking the diffusion of information technology for sustainability (Micheni, 2015). In looking at the adoption of big data in financial institutions in Kenya, Ndambo (2016) highlights the need for further research on the challenges of adopting big data analytics. There is a knowledge gap on the effects and challenges that telecommunication firms face by adapting big data analytics in Kenya. Therefore, this study aims at answering a research question that, what are these challenges affect the adoption of bid data analytics in telecommunication firms in Kenya?

1.3 Research Objectives

The general objective of the study will be to determine the challenges affecting adoption of big data analytics in telecommunications firms in Kenya.

The specific objectives of the study will be to:

i. To determine the extent of the effect of technological challenges such as internet connectivity on big data analytics in telecommunications firms in Kenya.
ii. To assess the manner in which data challenges influence big data analytics in telecommunications firms in Kenya.
iii. To assess the effect of process challenges on big data analytics in telecommunications firms in Kenya
iv. To determine the effect of management challenges in telecommunications firms in Kenya.
v. To generate a model that predicts and determines areas that telecommunication firms should invest and enhance in big data analytics to enhance their profitability and increase or maintain their competitiveness.

1.4 Hypothesis of the Study

The hypotheses that will be tested in the study include:

H1: Technological challenges will not affect big data analytics

H2: Data challenges will not affect big data analytics

H3: Process challenges will not affect big data analytics

H4: Managerial challenges will not affect big data analytics

1.5 Significance of the Study

The study will be important to firms in the telecommunications sector as it will provide a basis of adoption or less use of big data analytics. This is because the findings of this study will provide an insight of the challenges that affect the adoption of big data analytics and how to improve them. It will guide them on the path of adoption of big data analytics as well as

providing the challenges that firms are likely to face in the vigorous adoption of big data analytics it will guide these firms to make informed decisions while adopting this technology.

Research students as well as other future researchers will find the study useful as it will form an important part in building their empirical literature as well as providing necessary information that would guide them in identifying their research gap. The study will be important in enhancing their literature review and guiding on theoretical reviews as well as development.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review chapter is made up of various segments that acknowledge the contributions made by others in regard to the topic of the study. In the first place, the theories related to the study are highlighted in what is referred as the theoretical framework. The other segment in the chapter is comprised of empirical review that stipulates empirical studies that have been undertaken previously. The chapter also highlights the conceptual framework that denotes the variables of the study in a pictorial format.

2.2 Theoretical Framework

The section will highlight theories that are related to the study variables. The provision of the theory is highlighted as well as the proponent or the proponents of the theory. The relationship between the theory and this study is also highlighted and the critique of the theory is also brought out to provide a general understanding of the theory in relation to the study variables. The theories that have been suggested in this study include; Schumpeterian's Innovation Theory, The Resource Based View, and the Knowledge Based View.

2.2.1 Schumpeterian's Innovation Theory

Schumpeterian was keen to identify the critical role of innovation in any industry. The main way in which a company could obtain competitive advantage over other firms in the industry is to ensure that the company hedges on innovative tendencies that brings up new as well as improved products and services (Amit and Zott, 2001). Consumer preferences are therefore expected to be innate and never spontaneous. This could be interpreted to mean that despite the economic changes in the country, consumers are already aware of their needs (Schumpeter,

1934). It was therefore believed that innovation was a vital element in enhancing economic change. Schumpeter identified that market power, top-notch entrepreneurial activities, as well as innovativeness are key to turn around any economy. The theory therefore suggested that market power obtained through improved innovation had better economic outcomes than issues such as price competition. Innovativeness has also been known to create temporary monopolies as the first entrant to the market is key concept to gaining market leadership and gaining competitive edge. Price initiated competitiveness face stiff tussles from imitators and counterfeits that produce and distribute products and services at cheaper rates. The abnormal profits arising thereof become short lived. The theory therefore emphasized on developing new processes, services and products by the firms as it led to a more sustainable market power.

The theory stipulates a five-step process of implementing innovation in a company. The process starts with a re-launch of an already existing product or launching of a brand-new product. It then follows the introduction of new production or sales method which has not yet been introduced in the industry. The other step is to ensure that there is creation of new markets that did not previously exist, the identification of new raw materials sources and the final step is through implementation of a new industry structure which is superior to existing industry believes that to create abnormal profits, there is every need to encompass innovation.

2.2.2 The Resource-based View (RBV)

The resources owned by a firm are the base of Resource-Based Theory. It shows the ability of a firm to use its resources in a more efficient manner than the competition to provide a competitive edge over them. The acquisition of an asset superior to other assets in the industry, new processes, new capacities, and new capabilities makes the firm superior to the competition and provides point of enhancing its competitiveness. The resources in a firm may therefore be stipulated as information, assets, human capital, processes, capabilities which include big data analytics, which is useful to ensure that the firm is able to plan in improving its efficiency as

well as effectiveness in strategy implementation (Rugman and Verbeke, 2002). When a firm is able to use its resources that the rivals may not be in position to duplicate to provide a similar level of production, gives the firm a competitive edge. However, the sustenance of that competitiveness depends on the ability of the firm to use these four attributes: The firm must be committed in exploiting opportunities and neutralizing threats. The resource must also be imperfectly imitable (means that it is worth of imitation but very difficult to do so). The resource must also be rare and not easily accessible by the competitor and lastly, there should be no or rare substitutes that would be used to provide the same level of production (Rugman and Verbeke, 2002).

2.2.3 The Knowledge-Based View

This theory is related to Resource-Based View; however, knowledge has been held to be supreme as it contains attributes that make it so (Murray 2000; Teece et al. 1997; Tiwana 2002), it is therefore considered to be generic with more accurate output. This therefore provides a consistent outcome as big data analytics is essential in building knowledge and synthesizing information that is put into relevant use by cross functional teams in the organization in a way geared towards improving business processes which lead to innovation, cost reduction, and quality management among other processes.

The modern settings, where the world has become a global village, make it possible to hedge on technology to share data, knowledge and information. It is therefore difficult to create superior performance over others as such information is easily shared or imitated by rivals. The drivers of such superiority have therefore been reduced to enhancing competencies in the firm, promoting and exercise of intellectual properties, and improve on use of knowledge adequately (Hamel and Prahalad, 1994). Tiwana (2002) and Evans (2003) have also affirmed that the resource that sets two firms apart is knowledge as instead of decreasing with use,

knowledge improves with use. Firms that derive value in using knowledge therefore are expected to be better as they continually use this resource. On the contrary other resources decreases with use and therefore hedging on them as sources of competitive advantage would mean that their value would decrease with use (Evans, 2003). Tiwana (2002) also asserts that it is common knowledge that it is difficult to copy knowledge while it is very easy to copy and imitate other resources such as software, hardware, source of raw materials, and low prices.

2.3 Contextual Discussion

There are myriad of challenges arising from optimal use of big data. Issues in regard to processing system designs, the ability to scientifically analyse and make sense of data as well as other related research problems. Jin et al. (2015) suggests that among big data analytics is challenged by complexity of available data, computing the data as well as complexity in the systems required for its analysis. Similarly, Akerkar (2013) identified similar groups that pose significant challenges to big data that include availability of authentic data, processing data techniques, as well as management of data that could be associated with the transformation of data into valuable inputs as a way of enhancing the competitiveness of the organisation (Gandomi & Haider, 2015).

2.3.1 Technological Challenges

The technological challenges that surround biga data analytics could be further be broken down into time and costs. BDA projects, just like many similar projects, are not a one-off investment. They are, however, investments that are affected by other factors and variables which may come into play and distort the expected timelines for the completion of the projects and at a significant cost impact (Lambert, 2013). The nature of such projects requires the ability of implementing step-by-step procedures. The incremental procedure that is recommended in big data analytics is however expensive and may make it cumbersome to bring senior management

on board for such an initiative, that would derail the implementation and use of big data analysis in these organisations (lambert, 2013).

Another decisive factor that is considered is the ability of different vendors to integrate data. It is common knowledge that organisations choose partners that are competent and achieve results at minimum costs. The partners should also maintain an open communication channel where challenges are addressed promptly without delay or affecting routine operations. Telecommunication firms are known to maintain fragmented multiple systems as each system is known to address specific challenges. The partners should therefore be able to integrate such fragmented data, presented in different formats, and integrate it in a way that can make it possible for undertaking analysis to ensure credible information is obtained. It is therefore apparent that the partners should have knowledge and skills in data integration and management (Szaniawski, 2013). According to McCarthy and Bari (2013) there is a problem for Telecommunication firms to adopt a good BDA system, as data is always fragmented as it originates from different sources that have their own different way of presenting and working on data.

Veracity has on the other hard made it difficult for data analysts to make sense of data, as more complex data is generated every day. There are therefore more people who generate complex data in telecommunication industry, than people who are responsible of organising this data into logical format. The clumsiness that results in such a pool of data, may compromise on the analysis undertaken in the data and since GIGO (garbage-in-garbage-out) proposes that it is not possible to expect quality output from compromised data inputs (Gantz & Reinsel, 2012). Big data analytics requires the ability to scale operations and assure accurate results. However, technical challenges make it impossible to process large volume of data in a short period of time, as there is shortage of fast processing capacities (CPU) (Russom, 2011). The challenges

have therefore resulted in replacement of BDA platforms as a way of obtaining optimal performance and increased productivity in these organisations.

2.3.2 Data Challenges

The benefits of big data are clear and can be articulated with practical examples of firms that have acquired competitive advantage through optimizing the use of big data. However, there are real technical issues that require to be ironed out to ensure that the benefits are fully enjoyed (Jagadish et al., 2014). Kalan and Unalir (2016) brought into light challenges that surround data storage, challenges on capturing these data, maintaining quality of data, as well as poor infrastructure of handling the data all lie under technical challenges. Coleman et al. (2016) also brought out lack of skilled and competent personnel that would be in charge of data analysis in telecommunication firms. The position was also held by Probst et al. (2014) where lack of skilled and competent data scientists became the main hindrance in the European market for fostering analytical development. Despite the fact that data scientists are taking home hefty packages in term of remuneration, the issue of shortage in skilled personnel is yet to be addressed. Therefore, Coleman et al. (2016) note that telecommunication firms find it difficult to employ highly qualified data analysts, for the sake of sustainability.

According to a report by Digital Universe, digital data contained in digital storage infrastructure doubles every two years (Gantz and Reinsel, 2013). Bhosale and Gadekar (2014) raise concern over the data volume that is generated faster than the available resources to handle and synthesise it for decision making. Barnaghi, Sheth and Henson (2013) articulate that there exist different storage facilities where firms can be able to store their data. They stipulated cloud facilities, in-house built facilities or a hybrid system. Coleman et al. (2016) on the other hand is of the opinion that using cloud system as a storage facility is only convenient and cost effective for small firms, while it is similarly costly to set up an in-house facility, telecommunication firms are therefore caught up in the maze with bad and bad options to

choose from. Kalan and Unalir (2016) finds that telecommunication firms would be at a better position if they were able to secure services of a consulting firm that would be ready to handle their data issues, and tackle bottlenecks on data problem. Therefore, data storage challenges as well as inadequate skilled personnel on data handling and analysis, are connected to each other. Anagnostopoulos, Zeadally and Exposito (2016) were concerned of data storage where the use of converged as well as hyper-converged hardware or a software-defined storage enhances companies in scaling their hardware. Techniques such as compression, avoiding duplication, use of tiering are essential in the total reduction of total storage space and total costs (Nativi et al., 2015).

Quality of data should also be maintained to ensure that value is obtained from big data analysis (Najafabadi et al., 2015). Hashem et al. (2015) suggested that automatic data capture technology as well as AI (artificial intelligence) should be used in data verification. Kalan and Unalir (2016) poised on the importance of embarking on quality data by accurate measures for capturing data, as quality decisions would only result from relying on well captured and accurate data obtained from all possible data sources. This also calls for proper cleaning of data and proper enhanced data management process that would ensure that correct and accurate data has been captured (Soroka et al., 2017).

2.3.3 Process Challenges

The other challenge is process challenge as it was envisioned that lack of proper resources, lack of proper and competent analysts, and shortages in labour market, and the general cost for collecting and maintaining big data, bring out process challenge (Aishah et al., 2018). Ghobakhloo et al., (2012) are of the opinion that innovation is costly and expensive in every organisation. It is therefore clear that cost barriers are among the key hindrance to implement BDA in organisations (Noonpakdee, Phothichai and Khunkornsiri, 2018).

Ahmed et al. (2017) pointed the challenges on analysis itself. The difficulty in administration and rolling out of analysis tools and techniques, aligned together with improper data capturing and storage also become a setback to implementation of big data in organisations. Clustering voluminous data appropriately, aligning the data to the company processes, cleaning and sorting the data is only possible for firms that are well endowed in terms of proper infrastructure. It is only open and possible for firms that have been adequately invested and prepared for BDA (Jagadish et al., 2014). Chen, Argentinis and Weber (2016) highlight the consequences of misdiagnosis of data, or wrongful cleaning and sorting that would mean that the information that arises from such data is not only wrong, but also misleading that would eventually be very costly to the organisation. Making wrong decisions based on wrong information means that the organisation is misled and the strategies that it develops to achieve its objectives may never lead them in the correct path. Shah, Soriano and Coutroubis (2017) also emphasized on the bottlenecks that have been brought to the telecommunication firms by the issue of increased data volume and the speed of generation of new data. The use of traditional relational methods may be untenable in making a proper analysis and make accurate and proper decisions from such analysis.

Laney (2001) particularly pointed out the firms that are able to hedge on data they collect gain competitive edge over rivals. This, however, need to be done in time and accurately. It is therefore impossible for telecommunication firms to gain the competitive advantage if they are not in position to process and analyse data and make decisions timely (Del Vecchio et al., 2018). Similarly, Jagadish et al. (2014) brought out that the issue revolves on acquiring quick response to difficult issues despite there being large volumes. Furthermore, it is an uphill task to secure a model that would be compatible with the daily operations of the firm, unless the model has been tailor made to the specifics of data generated by the firm form one department to the other. Telecommunication firms are therefore drawn between setting up expensive tailor

made systems to hedge on big data, or acquire competent and highly skilled data specialists and analysts, who are expensive to maintain and sustain (Chong, Man and Rho, 2015). Nonetheless, Kalan and Unalir (2016) posits that it is impossible for telecommunication firms that are on a budget to gain value from big data, as the budget of undertaking tailor made solutions may be untenable, in the similar, context, use of competent and highly skilled personnel may not be possible as the cost of attracting and maintaining these specialists may be high above the set limit for the firm. Marx (2013) also indicates that the slowness of the use of data in firms is also related to the storage location of data either remotely, or in cloud systems. The time taken to access some of this information is therefore significant that it would lead to losses. The rate of transmission of information is affected and would as well affect operations. When data is stored in UK, but the actual users are in US and Japan, there is every chance that there will be delays in accessing the information that would mean that customers might be frustrated as services would be slower than expected in such situations. Marx (2013) however, failed to highlight the significance of challenges affecting firms due to large volumes of data generated.

2.3.4 Management Challenges

Smith (2007) cautiously indicated that the size of the firm is significant in suggesting the kind of management likely to be in control of such a firm. It is therefore indicative that management challenges are likely to increase with a small firm as they may not have the expertise of dealing with these challenges. Aishah et al. (2018) considered the assurance of providing data privacy and making steps in validating data security were critical issues on management of data while this was not the case as indicated by Sun et al. (2018) who thought that the issue of management challenges was dependent on the organisation structure where appropriate structure would be able to address the issue of management of data that would guarantee economic success when BDA is fully adopted (McAfee and Brynjolfsson, 2012). Proper data management was found

to be consistent with use of vertical organisation structure, and as such telecommunication firms that have adopted such a structure, would find it less difficult in data management (Goebel, Norman and Karanasios, 2015). Ghobakhloo et al. (2011) however put caution on the level of understanding, or exposure of data handling techniques and methods for middle level managers. Ignorance and half knowledge on the issue of big data is quite an issue, particularly when the parties assigned to handle the data are the culprits. The move increases risks to the shareholders who are left mitigating high risks of data privacy and data insecurity issues. The risks if not well managed would be tantamount to engaging in illegality. It would therefore be recommendable for these firms to ensure that they follow the recommended process of adoption of BDA which is itself a hindrance on use of big data in telecommunication firms.

It is important to note the position of the firm in regard to data management and data governance. There is need for each firm to highlight the need for data governance practices, as well as policies that should be adopted to ensure that data has been handled in a predetermined manner that is consistent with the policies and strategies of the firm (Posavec and Krajnovic 2016). Data management relies on handling data and how the data is treated and analysed to bring out synthesised information that can be used in decision making. Data from different sources is therefore gathered and analysed together with other form of data. It therefore implies that proper mechanism should be adopted to ensure that accuracy in data handling, data cleaning and data analysis has been put in place (Tallon, 2013). Research indicate that data governance is as important as any other role in the management of data. It ensures that data has been well handled in the entire process from capturing data, to storage, to cleaning, to sorting, to analysis and to interpretation of the findings from the data.

Data privacy is a very crucial effect that carries with it legal compliance issues as well as maintaining dignity of your customers and stakeholders. Confidentiality when handling personal data is therefore an issue that every organisation should ensure that it holds with the

weight it deserves (Jagadish et al., 2014). Jambunathan and Venkatesan (2016) stresses that a good number of organisations are not trustworthy that they hold personal data with the confidentiality that it deserves. Use of BDA makes a volatile issue worse as personal data is left exposed to more third parties seeking to make sense of the big data. Enrolling BDA is therefore encumbered with hurdles surrounding privacy issues that make the process slower than it is (Mardis, 2016). However, Marx (2013) suggests that encryption of data is a possible solution where, personal data obtained is first encrypted before it is stored, as well as during analysis. This maintains privacy and increases confidentiality measures even during transmission stage. The method is also suggested to be applicable for openly accessible servers that might be cheaper but less secure (Sorensen et al. (2010).

Telecommunication firms have data security challenges being the greatest nightmare as far as big data is concerned (Bhagwat and Sharma, 2007; Lafuente, 2015). Storage of data in the cloud is never a solution as the cyber insecurity is on the rise. Modern technology has also developed sophisticated decryption softwares that decrypt encrypted data (Tole, 2013). Sharma (2016) is however, optimistic that cloud computing has improved issues concerned with privacy, reliability as well as data security (Depeige and Doyencourt, 2015). Nevertheless, Coleman et al. (2016) underpins the threat and challenges facing telecommunication firms as far as guaranteeing data security is concerned.

2.3.5 Telecommunications Firms in Kenya

The telecommunications sector in Kenya has experienced rapid growth since 1999. The sector was first recognized through Telecommunications and Postal Sector Policy Statement of February 1997 and legislation of these practices consolidated the sector through the enactment of Kenya Information and Communications Act (KICA) in 1998. The Act was crucial in identifying the important role played by information and communication sector in the entire economic sector in the country. Reviews to the policy statement were undertaken in the year

2001 as well as 2006. The new developments in the technological arena, innovations and global interconnectivity necessitated amendments to the Act as its operationalization is aligned to technological developments in the country as well as to the impact in the society. These amendments relate to tariffs imposed on products, fair competition policy, consumer protection among others. Most of the development include increased connectivity as a result of improved technical capacities around payphones, paging services, enhanced mobile phone services and use of varied networks as well as use of Internet Service Providers (ISPs) (Mureithi, 2016).

There were only 4 licensed mobile phone service providers in Kenya. They included Safaricom, Airtel, Econet Wireless and Telkom Kenya (The only public fixed-network operator). Econet was however bought out by Airtel Kenya. The liberalisation in the telecommunication industry marshalled and enhanced mushrooming of service providers Including ISPs (Internet Service Providers) and cyber cafes. It is during this time that over 80 towns in Kenya were installed with cellular phone service network. There was also the opportunity for cheaper and more efficient communication channels such as use of E-mail as well as Voice Over Internet Protocol (VOIP), which was an improvement from telex, telegraph and bureau fax services (Christensen, 2001).

The Kenyan telecommunication industry is pegged on the provision of telephony services, provision of internet broadband and the infrastructure that supports all these services. This can therefore be categorized as telephony, internet, fibre-optic, undersea cables and the internet of things (IoT). The Kenya telecommunications sector experienced increased growth in 2018 which was clearly supported by the use of digital economy, affordable mobile telephony, as well as increased internet penetration. Internet access in the country is majorly by increased use and availability of affordable smart phones in the country. Statistics indicate that subscriptions in terms of data improved to 46.8 million, where almost half of these subscriptions were on broadband. The 19 companies in the industry have Safaricom being the

market leader with the greatest mobile and internet subscriptions. The other major players in the industry are Telkom Kenya, Airtel Networks, Finserve Africa and Mobile Pay. The country prides itself with the best use of mobile money transfer, as 58% of its population is believed to be subscribed to mobile money. Figures from the year 2019 indicates that active mobile money transfer subscriptions stood as 32 million with a total of 223,084 mobile money agents (Wood, 2019).

2.4 Empirical Studies

Empirical studies that have previously been undertaken but relates to this study are discussed in this chapter. These studies are organized depending on the specific objectives of the study and both local as well as global studies are reviewed. A research gap is also identified in each study and therefore justifies the undertaking of this study in its current form.

Kiziltan (2018) conducted a study of BDA challenges on SMEs in Turkey. The study aimed at determining the effect of resources, technical, skills, managerial and cultural challenges on adoption of BDA on SMEs in Turkey. The researcher surveyed the study variables to achieve study objectives. This study did a pilot study before collecting primary data. The study then collected primary data through questionnaires that were sent to respondents chosen using purposive sampling method. Only 171 responses were collected of which 61 responded that they had no knowledge about big data analytics and therefore only 110 responses were used in the analysis. The research used descriptive statistics to analyse data. In the outcome, among the five challenges only cultural challenges was found to have a unique statistically significance contribution to the model. The research was able to bring out comprehensively the challenges that hinder the adoption of big data in Turkish SMEs. However, more research need to be done in order to determine the challenges that telecommunication firms in Kenya undertake in adopting big data analytics.

Saenyi (2018) investigated on opportunities and challenges of big data analytics in healthcare. The aim of this study was to determine the opportunities and challenges of applying big data analytics in the management of sickle cell disease. The study applied both deductive and inductive approaches. Interviews were carried out to collect primary data which were specifically modified on the basis of the research framework. The research questions were then answered by caring out inductive analysis. In Saenyi's findings, implementation of big data analytics is faced with many challenges although there is potential. Some of these challenges are; government policies are not in place, many people in the world of sickle cell disease lack knowledge and some do not appreciate the importance of big data analytics and the legal implications for data security and privacy hinders the access of a lot of data and the process of complying is long and costly. This study does not show how the challenges statistically affect the adoption of big data analytics and therefore, more studies need to be done.

Wangari (2019) conducted a study to determine decision making capacities through hedging on BDA. The study employed descriptive research design and the data was collected from firms in telecommunication industry. A semi structured questionnaire was used to collect primary data which was analysed by Statistical Package for the Social Science (SPSS). Application of multiple linear regressions was done. Technological, environmental and organizational factors were found to have a high significant effect on the adoption of big data analytics. This study does not give the challenges of adopting big data analytics which shows a knowledge gap for more studies to be done.

Malaka and Irwin (2015) were keen to determine challenges for adoption of BDA in South Africa. The study was guided by the Technology-Organisation-Environment (TOE) model. Primary data was collected through interviews that were conducted to seven participants from

both Information Technology (IT) and business. Inductive approach was used to analyse data. The study findings revealed that technological challenges were faced whereby it was hard to attain the required standards of data quality and integrity, cost, performance and scalability data integration, data privacy and return on investment. From the organisation perspective, the major challenges were found to be skill shortages, ownership and control, unclear processes, silos, training and exposure, business focus and prioritisation. Such challenges therefore hindered the adoption of big data analytics in telecommunication firms in South Africa. Further studies need to be done to find out whether telecommunication firms in Kenya faces similar challenges when adopting the same technology.

Ochieng (2015), investigated the adoption of big data analytics by supermarkets in Kisumu County. The study aimed at determining the extent of adoption, the factors leading to adoption and the challenges of adopting the new technology in supermarkets in Kisumu County. Guided by TOE and diffusion of innovation, the study adopted cross-section study design and quantitative approaches in data collection. A population of 8 supermarkets were targeted whereby primary data was collected using closed ended questionnaires. SPSS software was used for analysis and descriptive statistics summarized nominal data. The study findings revealed that there was high usage rate of computer in all supermarkets although many were found not to have software that could manage unstructured data. Most lacked the required skills and infrastructure and despite dealing with big data they did not understand well the meaning and importance of big data analytics. A number of challenges hindered its adoption. A research gap exists where more studies need to be done on other different organisations in Kenya.

2.5 Study Gaps and Summary of Empirical Review

The empirical studies were drawn from the key four areas that make up the research objectives of this study. These are technological, data, process and managerial challenges that affect the adoption of big data analytics. The empirical studies that were considered by the study investigated the impact of some of these challenges that hinder the adoption of bid data analytics in telecommunication firms in other countries. This study therefore seeks to address the study gap through addressing these factors specifically as set out in the study objectives. Studies have also become impossible to have consistent results with variation in geographical differences, since different area have different level of technological growth and development. The frequent changes in technology as well as the frequent changing needs in customer needs, has brought out a field where consistent review should be undertaken in order to find the challenges that telecommunication firms face in adopting this technology. The study reviewed both local and international studies and no study that specifically focused on challenges that affect the adoption of big data analytics in telecommunications firms in Kenya. This becomes the major study gap that the study intends to address and provide new knowledge in the area.

2.5 Conceptual Framework

Conceptual framework is an analytical tool which indicates a written or a visual representation used to clearly show the relationship between variables. It may be applied in different cases and work categories, where the overall picture of the situation is required with the intent of making conceptual distinctions and organize ideas (Creswell, 2014).

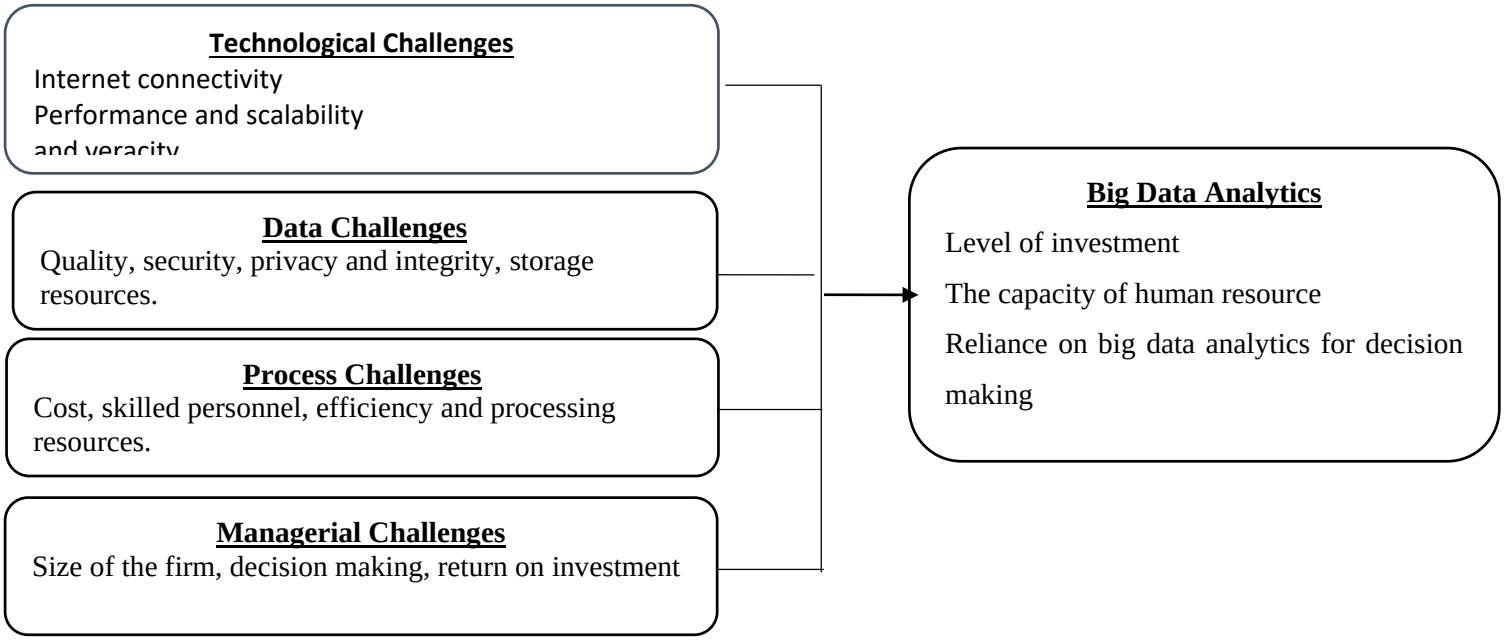

Figure 2.1: Conceptual Framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is critical in ensuring that it outlines the process and the techniques that will be chronologically applied in the study in order to achieve the research objectives and provide relevant and accurate answers to the research questions. It involves the research design appropriate for the research, the population of the study, sampling methods, data collection and data analysis.

3.2 Research Design

Research design is the overall strategy which a researcher decides upon, in order to integrate the different parts of the research in a coherent and a logical way. Choosing an appropriate research design ensures that the research problem is adequately addressed. Creswell (2014) insinuates that the process with which data is collected for the sole purpose of answering questions that concern the situation of the study variables would best be described by a descriptive research design. It is also essential in describing the relationship that exists between the study variables, which is the main concern of this study. For these reasons, the study will therefore adopt descriptive research design.

3.3 Population of the Study

There are 19 firms in the telecommunication industry in Kenya. These firms have different number of organization structure. It therefore explains the fact that there are different number of managers and top-level executives in different firms depending on the structure adopted. There are 500 managers and top executive officials in the telecommunication industry in

Kenya. These form the target population of our study as they have adequate information in regard to the challenges affecting the adoption of big data analytics by the company. The table 3.1 indicates the distribution of these managers across the firms.

Table 3. 1: Target Population Table

No.	Firm	No. Managers
1	Safaricom PLC	130
2	Airtel Networks Kenya Ltd	110
3	Telkom Kenya Ltd	50
4	Vodacom Group Ltd	20
5	DT One Fixed and Mobile Pte Ltd	15
6	East African Marines Systems Ltd (The)	10
7	Wananchi Group Kenya Ltd	8
8	ZTE (Kenya) Ltd	10
9	Eaton Towers Ltd	6
10	Ericsson Kenya Ltd	6
11	Finserve Africa Ltd	15
12	Liquid Telecom Kenya Ltd	23
13	MTN Business Kenya Ltd	15
14	Sea Submarine Communications Ltd	11
15	Space Engineering Ltd	8
16	Huawei Investment & Holding Co Ltd	15
17	NewTelco South Africa (Pty) Ltd	10
18	iWay Africa Kenya Ltd	10
19	Jamii Telecommunication Ltd	28
Total		**500**

Source: Human Resource Managers of the Telecommunication Companies (2020)

3.4 Sampling Design

The study will employ Taro Yamane formula to determine the sample size (Yamane, 1967).

The formula is given by

$n = N / (1+N(e)^2)$,

Where;

n is the correct sample size,

N represents the total population and

e is the margin of error which is 0.05

Therefore $n = 500/(1+500(0.05)^2)$

$n= 222.222$

The researcher will then round of to get 222 as the sample size that will be used for analysis in this study. The study will then adopt random stratified sampling design to select the elements of the sample. A random stratified sampling design refers to the method in which the population is divided into smaller groups that are known as strata, from which study respondents are randomly selected from each and every stratum (Creswell, 2014).

Table 3. 2: Sampling Design Table

No.	Firm	No. Respondents
1	Safaricom PLC	58
2	Airtel Networks Kenya Ltd	39
3	Telkom Kenya Ltd	23
4	Vodacom Group Ltd	10
5	DT One Fixed and Mobile Pte Ltd	8
6	East African Marines Systems Ltd (The)	8
7	Wananchi Group Kenya Ltd	8
8	ZTE (Kenya) Ltd	8
9	Eaton Towers Ltd	6
10	Ericsson Kenya Ltd	6
11	Finserve Africa Ltd	6
12	Liquid Telecom Kenya Ltd	6
13	MTN Business Kenya Ltd	6
14	Sea Submarine Communications Ltd	6
15	Space Engineering Ltd	6
16	Huawei Investment & Holding Co Ltd	5
17	NewTelco South Africa (Pty) Ltd	5
18	iWay Africa Kenya Ltd	5
19	Jamii Telecommunication Ltd	3
Total		**222**

3.5 Data Collection

Primary data will be collected by the use of semi-structured questionnaires. The questionnaires will be administered through drop and pick later method, where the respondent will have ample time to go through and understand the questions in the questionnaire. The questionnaires will also be administered electronically through the use of google forms, where the link to the forms will be sent to the respondents through email or through their phone contacts. Qualitative data will be collected from these semi-structured questionnaires and used for study analysis.

3.6 Data Analysis

Data collected will be analysed by the use of regression analysis, where the relationship between the independent variable and dependent variable will be determined. Correlational analysis will also be undertaken to determine the correlation between these study variables. The regression equation that will be adopted by the study will take the form:

$Y = \beta 0 + \beta\ 1X1 + \beta\ 2X2 + \beta\ 3X3 + \beta\ 4X4 + e$

Where:

Y = Big Data Analytics in Telecommunication firms in Kenya

β1, β2 and β3, β4, = Beta coefficients

β0 = Constant Term

X1 = Technological Challenges

X2 = Data Challenges

X3 = Process Challenges

X4 = Managerial Challenges

ε = Error term

3.7 Ethical Consideration

Ethical consideration in research concerns the ethical procedures that would be observed while conducting research. The researcher will seek informed consent from the respondents before a link to the questionnaire is sent to them. An introductory letter from the university will also be used by the researcher as an introduction before collecting data from the respondent. The respondents will be assured of anonymity and therefore the respondents would not be required to provide data that would identify them directly or indirectly. The researcher will also clearly explain that data collected by the researcher will be used for academic purposes and not for any monetary gain or for any other purpose than the stated purpose.

3.8 Project Management

The project will be undertaken as per the guidelines and timelines indicated in the Gant Chart in appendix III. Similarly, the tentative costs of the research project are clearly highlighted in the proposed budget in appendix IV.

CHAPTER FOUR

DATA ANALYSIS, SUMMARY AND PRESENTATION OF FINDINGS

4.1 Introduction

The chapter undertakes analysis of data collected by undertaking the descriptive analysis indicating the responses for each study variable. The determination of the significance of each factor towards the adoption of big data analytics is undertaken using regression analysis as well as correlational analysis. The summary of findings is thereby presented in the chapter.

4.2 Response Rate

The research targeted a total of 222 respondents, however complete data was obtained from a total of 158 respondents. This made up a response rate of 71.2% which Creswell (2014) suggests that response rate of 60% and above is adequate for undertaking research.

4.3 Descriptive Statistics

Descriptive statistics undertaken by the study sought to identify the different responses made by the study respondents and therefore describe the study variables by use of measures of central tendency of mean, standard deviation, median and mode to identify the frequencies of the responses by majority of the study respondents.

28.2% of the study respondents were obtained from Safaricom Limited while 20.5% of the respondents were from Airtel. Telkom Limited comprised a total of 14.7% of the respondents while the others were distributed across other Telecommunication firms in Kenya. 53.8% of the respondents were comprised of male respondents while 46.2% were female respondents that denoted that although there were more male respondents than female, there was no such

a great difference that would be an issue of concern for bias in relation to gender as depicted in figure 4.1.

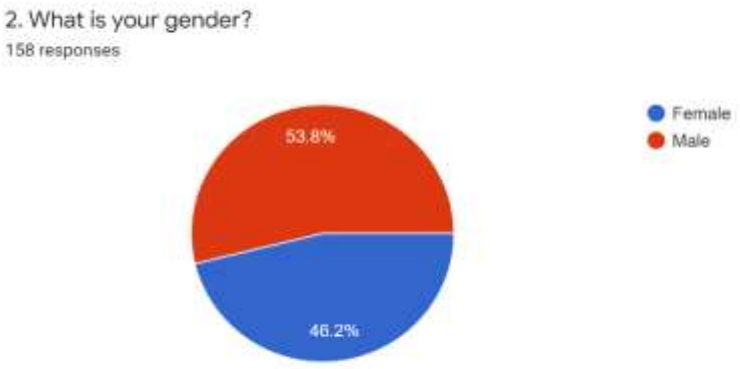

Figure 4. 1: Gender Distribution Chart

The distribution of respondents in terms of job title was distributed across different organization ranks in terms of senior management personnel being 17.7% of the respondents, 25.3% comprising of middle level managers, low level managers comprising of 27.2% of the respondents. The deliberate effort by the study to target managers was indicated by the fact that the highest number of respondents (31.4%) had at least attained graduate education while only a small percentage indicated that their highest level of education was high school graduate.

The use of computers across different telecommunication firms was evident as 83.4% indicated that there was a high use of computers in their organizations. The responses in regard to the big data analytics software used by the telecommunication firms as indicated by the study respondents is indicated in figure 4.2.

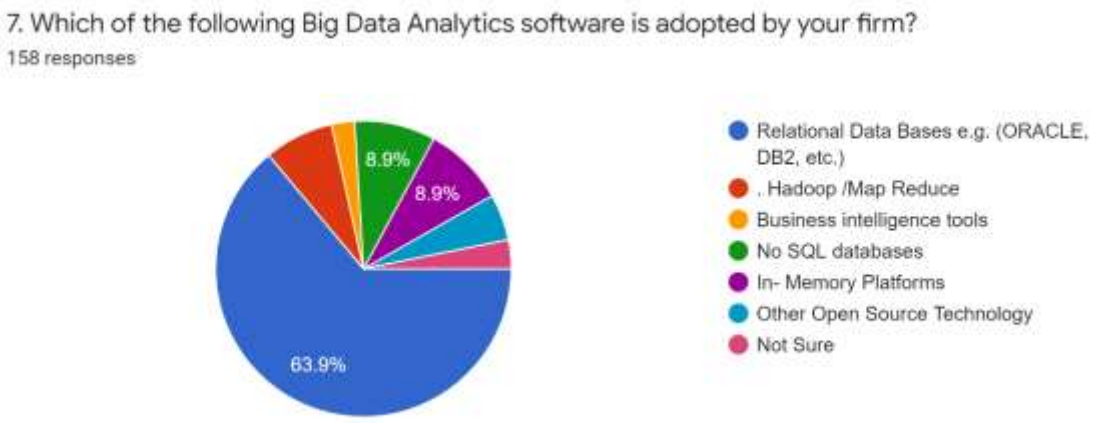

Figure 4. 2: Big Data Analytics Software

The study indicated that 63.9% of the respondents indicated that big data analytics software adopted by the firm was Relational Data Bases such as Oracle, DB2 among others.

4.3.1 Technological Challenges

Technological challenges were determined by use of 10 different questions and which the responses from the respondents indicated their assertions on technological challenges faced by their respective Telecommunication firms. The questions involved infrastructural challenges, technological infrastructure, internet connectivity, skilled personnel, as well as the necessary hardware and software. These variables were assessed and their mean, median and mode determined, where 1 indicated that the respondents highly agreed with the statement while 5 indicated that the respondents highly disagreed with the response.

Table 4.1 indicates the statistics that describe the variable in regard to technological challenges experienced by respective Telecommunication Firms in Kenya. All the questions had a median of 4 indicating that most respondents disagreed with the statements which depicted that there were low challenges in regard to infrastructure, hardware, software and access to required skilled personnel. However, the median for the statement, “The firm has poor internet connectivity required to enhance and facilitate big data analytics” was 2. This indicates that

the respondents agreed with the statement, depicting a scenario where most Telecommunication firms have poor internet connectivity.

Table 4. 1: Technological Challenges Statistics

Statistics

		[The firm lacks capacity to install modern infrastructure necessary for big data analytics]	[Hosting and maintaining the technological infrastructure is very difficult.]	[The firm has poor internet connectivity required to enhance and facilitate big data analytics]	[There is lack of required expertise among the staff members to fully adopt the use of big data analytics]	[The costs of installing the necessary hardware and software for big data analytics is beyond affordability of the firm]	[The firm does not upgrade infrastructure and modern technology required to fully benefit from big data analytics]	[The firm may not afford all the skills and expertise required to fully use technology in big data analytics]	[The technological infrastructure suffers from a lot of down time due to mechanical break downs]	[The company rarely upgrades equipment for big data analytics]	[The company does not prioritize spending on necessary equipment to enhance big data analytics]
N	Valid	158	158	158	158	158	158	158	158	158	158
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		3.72	3.37	2.72	3.46	3.41	3.48	3.28	3.00	3.55	3.37
Median		4.00	4.00	2.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00
Mode		5	4	2	4	4	4	4	4	4	4
Std. Deviation		1.266	.953	1.488	.864	1.035	1.027	1.128	1.282	.994	1.079

Source: Statistical Data, (2021)

4.3.2 Data Challenges

The data challenges that were investigated by the study included the storage of data challenges, observation of law and legal requirements in regard to handling data, expertise in data analysis, cost of data handling, security enhancement in regard to data and data privacy. These factors were assessed in a 5-point Likert scale, where each statement asked depicted inability of the firm to handle data challenge. Most of the statements had a mode of 4 and a mean of 3 with 1 standard deviation. It depicts variability in terms of different assessment in regard to data challenges. The worst score of data challenge with a mode of 1 and indicating that this was a point of concern for Telecommunication firms was “Big Data in the firm is always under threat from hackers and manipulation from dishonest staff.” This is a high-risk issue of concern that firms should undertake more investments to enhance security. Table 4.2 indicates the statistics depicting data challenges in these firms.

Table 4. 2: Data Challenges Statistics

Statistics

		[The firm lacks capacity to store non-traditional data types]	[The firm rarely observes necessary law in regard to data handling and storage of private data]	[The firm lacks the capacity to hire experts in data analysis]	[The cost of data handling, storage and analysis exceeds the benefit derived from big data analytics]	[data security and privacy laws hinder the firm from adoption of new technology.]	[The firm rarely derives value in storing big data]	[The firm lacks capacity to deploy qualified and skilled data handlers]	[Big data in the firm is always under threat from hackers and manipulation from dishonest staff]
N	Valid	158	158	158	158	158	158	158	158
	Missing	0	0	0	0	0	0	0	0
Mean		3.98	3.65	3.44	3.16	1.85	3.47	3.46	1.78
Median		4.00	4.00	4.00	3.00	2.00	3.00	4.00	1.00
Mode		4	4	4	4	2	3	4	1
Std. Deviation		1.037	.952	.974	1.006	.895	.779	.811	1.208

Source: Statistical Research Data, (2021)

4.3.3 Managerial Challenges

The quality of managers and challenges that face firms in keeping and maintaining highly qualified and productive managers in the firms was assessed. The study therefore undertook an assessment to understand whether managers support big data analytics in the firm, enhancing digitization of operations, enhancing organization culture in terms of adoption of BDA. All these managerial challenges were assessed in a similar 5-point Likert scale where 5 represented strongly disagreed while 1 represented strongly agreed with the challenge. The common mean and medium was 4 indicating that the respondents disagreed with the challenge while the respondents agreed with the challenge that “Privacy and security of customer information is a major barrier to implementation of big data analytics. This statement had a mean, mode and median of 2, indicating the increased challenge of data privacy and managing data privacy and enhancing data security. However, most respondents disagreed that management do not support BDA in these firms. The median and mode was 5 as summarized in table 4.3.

Table 4. 3: Managerial Challenges Statistics

Statistics

		[Top management do not supports implementation of big data analytics as a business innovation for competitive advantage by availing resources]	[digitization of operation has not succeeded in making it possible to implement big data analytics to bring down internal coordination costs]	[Organization culture and mission is not conducive for the development of big data analytics technology]	[The firm does not rely on Bda when makings decisions.]	[Most employees lack adequate knowledge of Bda technology]	[Privacy and security of customer information is a major barrier to implementation of big data analytics]	[adopting Bda as a new way of doing business faces internal resistance.]	[There is fear of risking in adopting Bda among the top management whereby it may lead to losses or low return on investment]
N	Valid	158	158	158	158	158	158	158	158
	Missing	0	0	0	0	0	0	0	0
Mean		4.39	3.74	3.85	3.56	3.66	2.47	3.56	3.20
Median		5.00	4.00	4.00	4.00	4.00	2.00	4.00	3.00
Mode		5	4	4	4	4	2	4	4
Std. Deviation		.873	.861	.916	.885	.907	1.045	.892	1.021

Source: Statistical Research Data, (2021)

4.3.4 Process Challenges

The process challenges were identified as the ability for the firm to understand the processes in big data analytics, collection and storage of big data, effective policies for big data analytics, whether the organizational culture is congruent to undertaking and enhancing big data analytics.

These factors were assessed on a 5-point Likert scale, where 5 indicated that the respondents strongly disagreed with existence of the challenge in the respective firm, while 1 indicated that the respondents strongly agreed that the challenge was applicable to the respective firm.

Most of the responses indicated that they disagreed with presence of the challenge in their respective firms as they had a mode or median of 4. However, the respondents agreed with the presence of the following challenges which had a mean and median of 2: “The firm is not well endowed to collect big data” and The firm is better off outsourcing big data analytics than in-house undertaking of the same” These are critical areas that affects the process of undertaking big data analytics in these firms. The statistics for each question are depicted in Table 4.4.

Table 4. 4: Process Challenges Statistics

Statistics

		[The firm does not fully understand processes involved in BDA]	[The firm is not well endowed to collect big data]	[The firm lacks formal laid down policy in regard to big data and big data analytics]	[The firm is better off outsourcing big data analytics than in-house development of this capacity]	[The culture of the firm is not well integrated with BDA]	[Employees are not sensitized on BDA and its importance]	[BDA rarely takes significant budget of the firm]
N	Valid	158	158	158	158	158	158	157
	Missing	0	0	0	0	0	0	1
Mean		3.84	3.24	3.56	2.79	3.35	3.41	3.32
Median		4.00	3.00	4.00	3.00	3.00	4.00	3.00
Mode		4	2	4	2	4	4	3
Std. Deviation		.974	1.061	.856	1.257	.917	.911	.864

Source: Statistical Research Data, (2021).

4.3.5 Adoption of Big Data Analytics

The adoption of BDA indicates the extent to which big data analytics has been adopted and integrated by each corresponding Telecommunication Firm as assessed by each study respondent. The statements that were assessed by the respondents include the extent of adoption of BDA, the reliance on BDA by management, the availability of well trained and skilled personnel to handle BDA, the investment undertaken by a company in support of BDA as well as the adoption of use of BDA and integration into the company's culture.

A 5-point Likert scale was also adopted by the study where 1 indicates that the respondent strongly disagreed that the respective firm implemented the specific issue that led to enhanced adoption of BDA. The other extreme of 5 indicates that the respondent strongly agreed with the statement that the company had undertaken tremendous steps in the adoption of BDA. Table

4.5 indicates that all the statements had a mode and median of 4 except the statement "the company has obtained more accurate results from adoption and use of BDA."

Table 4. 5: Adoption of Big Data Analytics

Statistics

		[The companyy fully adopts use of big data analytics]	[The management fully relies on data in making critical business decisionss]	[The company has a policy related to use, storage, and analysis of big data]	[The company has well skilled and qualified personnel in charge of big data analysis]	[The company has earned a competitive edge against competitors as a result of undertaking BDA]	[The company trains personnel and staff on handling and storage of big data analytics]	[There is coordinated support by all staff in enhancing use of BDA in decision making]	[The company has integrated adoption and use of BDA on organizational culture]	[The company has undertaken adequate investment to enhance data safety and data security.]	[The company has obtained more accurate results from the adoption and use of BDA.]
N	Valid	158	158	158	158	158	158	158	158	158	158
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		3.04	2.97	3.44	3.56	3.43	3.53	3.42	3.42	3.56	3.04
Median		3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
Mode		4	4	4	4	4	4	4	4	4	3
Std. Deviation		1.241	1.015	1.000	.961	1.274	.915	.847	.919	.856	1.024

Source: Statistical Research Data, (2021)

4.4 Correlational Analysis

The correlational analysis undertakes to determine the correlation between each independent factor (challenge) and adoption of big data analytics. It indicates whether there exists any form of relationship, whether positive or negative relationship as well as indicate whether the relationship is strong or weak, significant or insignificant.

The use of Pearson's Correlation was adopted in the study where correlation ranges from 1 to 0. It can either be positive or negative, where 0 indicates no correlation and figures close to zero indicate weak correlation. Figures close to one indicate strong correlations. Table 4.6 informs the results of this analysis.

The correlation between technological challenges and adoption of BDA has a strong and significant correlation of 0.736, while the correlation of data challenges and adoption of BDA was also significant but slightly weaker at 0.558. Managerial challenges and adoption of BDA

despite being significant, the correlation is relatively weak at 0.314, but process challenges is a significant and relatively stronger at a correlation rho of 0.539.

Table 4. 6: Correlation Analysis

Correlations

		Adoption of Big Data Analytics	Technological Challenges	data Challenges	Managerial Challenges	Process Challenges
Adoption of Big Data Analytics	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	158				
Technological Challenges	Pearson Correlation	.736**	1			
	Sig. (2-tailed)	.000				
	N	158	158			
data Challenges	Pearson Correlation	.558**	.632**	1		
	Sig. (2-tailed)	.000	.000			
	N	158	158	158		
Managerial Challenges	Pearson Correlation	.314**	.267**	.269**	1	
	Sig. (2-tailed)	.000	.001	.001		
	N	158	158	158	158	
Process Challenges	Pearson Correlation	.539**	.551**	.437**	.327**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	158	158	158	158	158

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Statistical Research Data, (2021)

4.5 Regression Analysis

Multiple regression analysis was adopted by the study to determine the challenges affecting adoption of big data analytics in Telecommunication firms in Kenya. The model adopted by the study was derived as follows:

$Y = \beta 0 + \beta\ 1X1 + \beta\ 2X2 + \beta\ 3X3 + \beta\ 4X4 + e$

Where:

Y = Big Data Analytics in Telecommunication firms in Kenya

β1, β2 and β3, β4, = Beta coefficients

X1 = Technological Challenges

X2 = Data Challenges

X3 = Process Challenges

X4 = Managerial Challenges

ε = Error term

4.5.1 Regression Model Summary

Table 4. 7: Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.764[a]	.583	.572	4.094

a. Predictors: (Constant), Process Challenges, Managerial Challenges, data Challenges, Technological Challenges

The summary table is key as it indicates coefficient of determination that is denoted by R square. Table 4.7 indicates R square of 0.583 indicating that the model affects changes in the adoption of BDA to an extent of 58.3%. The other 41.7% is influenced by other factors and other challenges that are not represented in this study.

4.5.2 Variance Analysis

This is represented by ANOVA analysis which determines the significance of F test. The test suggests that when the P value is greater than alpha value of 0.05, then the study should fail to reject the null hypothesis, while the null is rejected if the p-value is less than 0.05.

Table 4. 8: ANOVA TABLE

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3585.430	4	896.358	53.467	.000[b]
	Residual	2565.000	153	16.765		
	Total	6150.430	157			

a. Dependent Variable: Adoption of Big Data Analytics

b. Predictors: (Constant), Process Challenges, Managerial Challenges, data Challenges, Technological Challenges

Table 4.8 indicates that the significance (p-value) is 0.000 and therefore less than 0.05. The study therefore rejects the null hypothesis and concludes that there is significant effect of the identified challenges in adoption of big data analytics in Telecommunication firms in Kenya.

4.5.3 Coefficients

The coefficients of the model are defined in table 4.9.

Table 4. 9: Coefficients Table

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.554	2.747		1.658	.099
	Technological Challenges	4.718	.626	.553	7.532	.000
	data Challenges	1.268	.730	.119	1.736	.085
	Managerial Challenges	1.036	.687	.084	1.508	.134
	Process Challenges	1.749	.728	.155	2.404	.017

a. Dependent Variable: Adoption of Big Data Analytics

The table indicates that the model adopted by the study is transformed into

$$Y = 4.55 + 4.718X_1 + 1.268X_2 + 1.036X_3 + 1.749X_4 + 2.747$$

This indicates that technological challenges have the strongest effect on adoption of BDA in Telecommunication firms in Kenya. They are followed by Process challenges, closely followed by data challenges and managerial challenges are the least challenges to influence adoption of big data analytics. This suggests that Telecommunication firms that would wish to adopt big data analytics should ensure that they address technological challenges in form of hardware and software, relevant skills and competence in data analysis as well as enhance internet connectivity.

The firms should also be concerned with factors affecting process challenges collection and storage of big data, effective policies for big data analytics, whether the organizational culture

is congruent to undertaking and enhancing big data analytics. Data challenges should also be addressed and most significantly issues relating to privacy of the data, security, storage and data handling should be addressed adequately. Managerial challenges although affect adoption of BDA, the effect is relatively low.

4.6 Summary and Interpretation of Study Findings

The study findings were very relevant and quite informative in relation to the study. The challenges that influence adoption of data analytics in Telecommunication firms in Kenya insinuates that Technological challenges, data challenges, managerial challenges and process challenges are critical factors in influencing adoption of BDA.

The respondents pointed those technological challenges such as hardware and software were issues of concern as they indicated that respective firms had inadequate hardware and software that could not suffice in adoption of BDA. Similarly, internet connectivity was not well enhanced and was a factor that contributed to technological challenges. With enhanced and a more emphasis on technological challenges faced by Telecommunication firms in Kenya, then there would be increased use and adoption of BDA. The correlation of adoption of BDA with technological challenges was significant and very strong at 0.736 and therefore indicating that it is a real and vital challenge that ought to be addressed. Priority should therefore be enhanced on addressing technological challenges to enhance adoption of BDA.

Data challenges were also found to have significant correlation with adoption of big data analytics at Pearson's rho of 0.558. The specific challenges that were picked out in the study include storage of data, security issues such as hacking, and manipulation of data ranked highly among the unique challenges affecting data. The inability to analyse data was also cited as among the challenges. The study therefore found that data challenges had significant impact in the adoption of big data analytics.

Managerial challenges were also found to be very critical in enhancing adoption of BDA. The skills level, competence as well as the ability of managers to inculcate BDA into the culture of the organization were found to be critical factors in the adoption of BDA. The correlational analysis of the study was found to be significant, but it was relatively weak at 0.314. It therefore denotes that despite the fact that having competent managers as well as managers who are willing to inculcate BDA into the culture of the firm, the firms have performed well in addressing this challenge.

The study found that process challenges were significant and affected adoption of BDA. The correlation analysis had a Pearson's rho of 0.539 which was significant. It indicates that the challenge is a vital challenge and adoption of BDA requires the firm to enhance their competence in data collection, data analysis, use of modern and current techniques would also be adequate in addressing the challenge. Process challenges were vital as a good number of respondents thought adoption of big data analytics would be better off outsourced in other firms.

The study findings were congruent to findings indicated by Saenyi (2018) who found that adoption of BDA was vital in bringing out challenges affecting sickle cell anaemia. Saenyi's findings, indicated that implementation of big data analytics is faced with many challenges although there is potential. Some of these challenges included government policies are not in place, many people in the world of sickle cell disease lack knowledge and some do not appreciate the importance of big data analytics and the legal implications for data security and privacy hinders the access of a lot of data and the process of complying is long and costly. Similarly, Wangari (2019) found that technological, environmental and organizational factors have a high significant effect on the adoption of big data analytics.

The study findings were contrary to findings by Kiziltan (2018) who found that among the five challenges that were investigated by the study only cultural challenges was found to have a unique statistically significance contribution to the model. The research was able to bring out comprehensively the challenges that hinder the adoption of big data in Turkish SMEs. Similarly, Malaka and Irwin (2015) revealed that technological challenges made it hard to attain the required standards of data quality and integrity, cost, performance and scalability data integration, data privacy and return on investment. From the organisation perspective, the major challenges were found to be skill shortages, ownership and control, unclear processes, silos, training and exposure, business focus and prioritisation. This contradicts our findings where managerial challenges as were not found to be very critical challenges in adoption of BDA.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS OF THE STUDY

5.1 Introduction

The chapter highlights the summary of the study as well as the conclusion that was derived from the summary undertaken in the study. The chapter then makes recommendations as they arise from the conclusions of the study, the limitations of the study and areas for future research.

5.2 Summary of the Study

Big data analytics is a crucial concept that has made companies to obtain an edge by collecting and making sense of data in regard to their customers, products as well as other critical details. These companies generate so much information and data that if well analysed would provide a strategic direction and the company will be in position to understand its critical role in the market. Information is vital for upholding strategies and trading becomes more impactful with the right market information. It is therefore in the interest of companies as well as corporations to ensure that they invest adequately and improve their technological capacities and competence in making sense of data they collect. The study therefore undertook to determine the challenges that affect adoption of big data analytics in Telecommunication firms in Kenya.

The study therefore undertook a descriptive research design, as well as a correlational design to correlate the challenges with adoption of BDA. The study relied on primary data where data was collected from managers in these firms. Structured questionnaires were sent to the study respondents and both correlational analysis together with regression analysis were undertaken by the study. The study findings were very relevant and quite informative in relation to the study. The challenges that influence adoption of data analytics in Telecommunication firms in Kenya insinuates that Technological challenges, data challenges, managerial challenges and process challenges are critical factors in influencing adoption of BDA.

The respondents pointed those technological challenges such as hardware and software were issues of concern as they indicated that respective firms had inadequate hardware and software that could not suffice in adoption of BDA. Similarly, internet connectivity was not well enhanced and was a factor that contributed to technological challenges. With enhanced and a more emphasis on technological challenges faced by Telecommunication firms in Kenya, then there would be increased use and adoption of BDA. The correlation of adoption of BDA with technological challenges was significant and very strong at 0.736 and therefore indicating that it is a real and vital challenge that ought to be addressed. Priority should therefore be enhanced on addressing technological challenges to enhance adoption of BDA.

Data challenges were also found to have significant correlation with adoption of big data analytics at Pearson's rho of 0.558. The specific challenges that were picked out in the study include storage of data, security issues such as hacking, and manipulation of data ranked highly among the unique challenges affecting data. The inability to analyse data was also cited as among the challenges. The study therefore found that data challenges had significant impact in the adoption of big data analytics.

Managerial challenges were also found to be very critical in enhancing adoption of BDA. The skills level, competence as well as the ability of managers to inculcate BDA into the culture of the organization were found to be critical factors in the adoption of BDA. The correlational analysis of the study was found to be significant, but it was relatively weak at 0.314. It therefore denotes that despite the fact that having competent managers as well as managers who are willing to inculcate BDA into the culture of the firm, the firms have performed well in addressing this challenge.

The study found that process challenges were significant and affected adoption of BDA. The correlation analysis had a Pearson's rho of 0.539 which was significant. It indicates that the

challenge is a vital challenge and adoption of BDA requires the firm to enhance their competence in data collection, data analysis, use of modern and current techniques would also be adequate in addressing the challenge. Process challenges were vital as a good number of respondents thought adoption of big data analytics would be better off outsourced in other firms.

5.3 Conclusion of the Study

The conclusion that would be made from the summary of the study indicates that technological challenges have the strongest effect on adoption of BDA in Telecommunication firms in Kenya. They are followed by Process challenges, closely followed by data challenges and managerial challenges are the least challenges to influence adoption of big data analytics. This suggests that Telecommunication firms that would wish to adopt big data analytics should ensure that they address technological challenges in form of hardware and software, relevant skills and competence in data analysis as well as enhance internet connectivity.

The firms should also be concerned with factors affecting process challenges collection and storage of big data, effective policies for big data analytics, whether the organizational culture is congruent to undertaking and enhancing big data analytics. Data challenges should also be addressed and most significantly issues relating to privacy of the data, security, storage and data handling should be addressed adequately. Managerial challenges although affect adoption of BDA, the effect is relatively low.

5.4 Study Recommendations

The study therefore makes several recommendations in line with the study findings. In the first instance the study recommends that Telecommunication firms in Kenya should enhance their technological capacity. This would be adequate to address technological challenge in form of improving their hardware and ensure that they make use of modern software that would support

analysis of big data. Similarly, the employees should be adequately trained to enhance their competence in regard to big data analysis. The technological challenge should also be dealt with by improving internet connectivity that enhances their ability to access as well as enhance strong internet connections for their clients.

The study would also recommend that Telecommunication Firms should ensure that process challenges are well addressed. The process challenges would include the ability for the firm to understand the processes involved in big data analytics, collection and storage of big data. The firms should ensure they implement effective policies for big data analytics and ensure that their culture is developed to capture and involve enhancing big data analytics. The policies adopted and the training of employees would therefore be vital to ensure that processed in BDA have been integrated into the culture of the organization.

The storage of data as well as enhancing privacy of data is an issue that should be well observed by Telecommunication firms. Upholding privacy for personal data is among ethical and to some extent legal issues that should be well observed and adhered by any firm. This entails investment in data handling tools that would ensure that privacy for all data is well upheld and personal data is protected. Data security is a critical issue where the government should set standards that controls the use, storage and distribution of personal data in the disposal of any firm. It would be a good practice if GDPR and CCPA compliance is emphasized in Kenya.

The study also recommends that despite the fact that managers are well aware and aligned to enhance and support BDA, managers should be well informed by enhancing trainings and workshops. They should ensure that managers are well trained to understand the benefits of relying on accurate data in making organizational decisions.

5.5 Limitations of the Study

There are several limitations that might be impactful on the findings of the study. However, great attention and critical effort was undertaken to ensure that the study is done with high standards of precision. The study adopted primary data collection tool and specifically structured questionnaires. The accuracy of the responses may therefore be compromised by the respondents' need to ensure they shape the responses in a certain desired way that may compromise the accuracy of the results. The researcher, however, was clear that the objective of the study was purely for academic purposes and the responses were anonymous and confidential. The respondents were requested to respond to the questions as truthful as possible.

The study was undertaken for Telecommunications in Kenya. However, all firms have access to data that is sometimes transformed to big data. The study would therefore be applicable to all sectors of the economy and challenges affecting BDA would be assessed across the economic sectors. The study should therefore not be limited to focus on Telecommunications Firms in Kenya, but the study should be extended to other sectors of the economy as well as to other countries both developing and developed countries.

The study was also limited by time where structured questionnaire was adopted to collect data from correspondent. A conclusive study undertaken to incorporate use of interviews to the respondents would supplement questionnaires, and the researcher would be able to observe the respondents as well as ask for clarifications for areas that were not clearly brought out by the questionnaire.

The study also focused on four challenges which were able to influence 79.4% of the changes in adoption of big data analytics. A similar study should therefore be undertaken where more factors and challenges should be implemented in the model and their effect on adoption of BDA assessed.

5.6 Recommendations for Future Research

Future researchers should therefore undertake a study not only limited on Telecommunications firms in Kenya, but a study that would focus on adoption of BDA in other developing and developed nations and the findings of such a study compared to the findings of this study.

The future study should also adopt a different model of analysis, where regression model is not adopted as the basis of analysis. The limitations made by regression model makes the method unsuitable in some scenarios and in some instances. A non-parametric model would therefore be suitable where assumptions of the models are not an issue of concern to affect the model.

A similar study would also be undertaken with more factors and challenges investigated and therefore determine whether there is a significant change between the findings of such a study and this study.

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APPENDICES

APPENDIX I: LIST OF TELECOMMUNICATION COMPANIES IN KENYA

1. Airtel Networks Kenya Ltd
2. DT One Fixed and Mobile Pte Ltd
3. East African Marines Systems Ltd (The)
4. Eaton Towers Ltd
5. Ericsson Kenya Ltd
6. Finserve Africa Ltd
7. Huawei Investment & Holding Co Ltd
8. Jamii Telecommunication Ltd
9. Liquid Telecom Kenya Ltd
10. MTN Business Kenya Ltd
11. NewTelco South Africa (Pty) Ltd
12. Safaricom PLC
13. Sea Submarine Communications Ltd
14. Space Engineering Ltd
15. Telkom Kenya Ltd
16. Vodacom Group Ltd
17. Wananchi Group Kenya Ltd
18. ZTE (Kenya) Ltd
19. iWay Africa Kenya Ltd

APPENDIX II. QUESTIONNAIRE

SECTION A: BACKGROUND INFORMATION

Please select/write the most suitable answers that apply to you

1. What is the name of your organization? _____

2. What is your gender?

A. Male B. Female

3. **What is your job title?**

A. Senior Management B. Middle Level Management

C. Low level management D. Others

4. **What is your highest education level?**

A. Secondary School Graduate B. Diploma Holder

C. Graduate Diploma D. Masters Degree/Post Graduate

D. Doctorate

5**. How long have you worked with the current employer?**

A. 0-3 Years B. 4 – 10 years

C. 11- 15 Years D. Over 15 years

SECTION B

Use of Big Data Analytics by the Firm

6. Please indicate the rate of use of computers in your firm

A. Low B. Medium C. High D. None of these apply

7. Which of these softwares is adopted in your firm

A. Relational Databases such as ORACLE, DB2, etc

B. Handoop/Map reduce

C. Business Intelligence Tools

D. No SQL databases

E. IN-Memory Platforms

F. Other Open Source Softwares

G. Not sure

8.Which data type is used for collection and analysis in your firm.

A. Social media data

B. Sensor Data

C. Historical Data

D. Spatial Data

E. Voice Data

F. Mobile Data

G. Multimedia Data

H. Transactional Data

9. Specify the amount of data processed every day by your firm.

A. Less than 100GB

B. 100GB – 1 TB

C. 1TB to 5TB

D. 5TB to 10TB

E. 10TB to 100 TB

F. Above 100TB

SECTION C

TECHNOLOGICAL CHALLENGES AFFECTING THE ADOPTION OF BIG DATA ANALYTICS.

Please tick each statement according to the manner in which you agree with the statement as applicable in your organization. SD- strongly disagree, D- Disagree, N-Neutral, A – Agree and SA, Strongly Agree.

		SD	D	N	A	SA
1	There is inadequate infrastructure for BDA					
2	Hosting and maintenance of technology infrastructure is a challenge					
3	Poor internet connectivity to enhance BDA					
4	Insufficient human skills to facilitate BDA					
5	Cost of hardware and software for BDA is unaffordable to the firm					
6	The firm fails to upgrade necessary infrastructure to conform to modern standards					
7	The firm can't afford required skilled labour for enhancing BDA					
8	Technological infrastructure is prone to consistent breakdowns increasing down time					

9	Upgrade of equipment and software is rarely done by the firm					
10	No priority on BDA equipment and infrastructure					

SECTION D

DATA CHALLENGES AFFECTING THE ADOPTION OF BIG DATA NALYTICS.

Please tick each statement according to the manner in which you agree with the statement as applicable in your organization. SD- strongly disagree, D- Disagree, N-Neutral, A – Agree and SA, Strongly Agree.

		SD	**D**	**N**	**A**	**SA**
1	The firm lacks capacity to store non-traditional data types					
2	The firm rarely observes necessary law in regard to data handling and storage of private data					
3	The firm lacks the capacity to hire experts in data analysis					
4	The cost of data handling, storage and analysis exceeds the benefit derived from big data analytics					
5	The firm find it more expensive to acquire storage space for big data than the benefit it derives from it					
6	Data security and privacy laws hinder the firm from adoption of new technology.					
7	The firm rarely derives value in storing big data					
8	The firm lacks capacity to deploy qualified and skilled data handlers					
9	Big data in the firm is always under threat from hackers and manipulation from dishonest staff					

SECTION E

MANAGERIAL CHALLENGES AFFECTING THE ADOPTION OF BIG DATA ANALYTICS.

Please tick each statement according to the manner in which you agree with the statement as applicable in your organization. SD- strongly disagree, D- Disagree, N-Neutral, A – Agree and SA, Strongly Agree.

		SD	D	N	A	SA
1	Top management do not supports implementation of big data analytics as a business innovation for competitive advantage by availing resources					
2	Digitization of operation has not succeeded in making it possible to implement big data analytics to bring down internal coordination costs					
3	Organization culture and mission is not conducive for the development of big data analytics technology					
4	The firm does not rely on BDA when makings decisions.					
5	Most employees lack adequate knowledge of BDA technology					
6	Privacy and security of customer information is a major barrier to implementation of big data analytics					
7	Adopting BDA as a new way of doing business faces internal resistance.					
8	There is fear of risking in adopting BDA among the top management whereby it may lead to losses or low return on investment					

SECTION F

PROCESS CHALLENGES AFFECTING THE ADOPTION OF BIG DATA ANALYTICS.

Please tick each statement according to the manner in which you agree with the statement as applicable in your organization. SD- strongly disagree, D- Disagree, N-Neutral, A – Agree and SA, Strongly Agree.

		SD	D	N	A	SA
1	The firm does not fully understand processes involved in BDA					
2	The firm is not well endowed to collect big data					
3	The firm lacks formal laid down policy in regard to big data and big data analytics					
4	The firm is better off outsourcing big data analytics than in-house development of this capacity					

5	The culture of the firm is not well integrated with BDA					
6	Employees are not sensitized on BDA and its importance					
7	BDA rarely takes significant budget of the firm					

SECTION G

ADOPTION OF BIG DATA ANALYTICS

Please tick each statement according to the manner in which you agree with the statement as applicable in your organization. SD- strongly disagree, D- Disagree, N-Neutral, A – Agree and SA, Strongly Agree.

		SD	**D**	**N**	**A**	**SA**
1	The company fully adopts use of big data analytics					
2	The management fully relies on BDA in making critical business decisions					
3	The company has a policy related to use, storage, and analysis of big data					
4	The company has well skilled and qualified personnel in charge of big data analysis					
5	The company has earned a competitive edge against competitors as a result of undertaking BDA					
6	The company trains personnel and staff on handling and storage of big data analytics					
7	There is coordinated support by all staff in enhancing use of BDA in decision making					
8	The company has integrated adoption and use of BDA on organizational culture					
9	The company has undertaken adequate investment to enhance data safety and data security.					
10	The company has obtained more accurate results from the adoption and use of BDA.					

- THE END!! THANK YOU! –

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APPENDIX III: GANTT CHART

	Activities	Apr- June 2021	Jul-Aug 2021	Sep 2021	Oct 2021	Nov 2021	Dec 2021
1	Research Proposal						
2	Defense						
3	Data Collection						
4	Data Analysis						
5	Project Defense						
6	Binding Final Copies						

APPENDIX IV: PROPOSED BUDGET

No.	**Activity**	**Amount (Kshs)**
1.	Data Collection/Internet/Airtime	15,000
2.	Printing Costs	15,000
3.	Travelling costs	40,000
4.	Photocopying and Binding Costs	10,000
5.	Miscellaneous Expenses	10,000
TOTAL		**90,000.00**