BIG DATA ANALYTICS AND COMPETITIVE ADVANTAGE OF COMMERCIAL BANKS AND FINTECH COMPANIES IN KENYA

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DECLARATION

This project report is my original work and has not been submitted for the award of a degree in any other University.

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This project is dedicated to my immediate family who have shown me steadfast support in the course of my studies. I dedicate it to my husband for his selfless support and keeping me motivated till the very end. To my daughter, thank you for being so understanding of my absence during the course of my academics. I cannot forget my mum who always prayed for complete my studies successfully; you're such a blessing in my life. To my family who understood when I missed important family occasions to attend classes and sit for examinations, I appreciate you. Finally, to all my friends who kept encouraging me to move on, thank you very much.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASIC	-	Australian Securities and Investments Commission
ATM	-	Automated Teller Machine
BDA	-	Big data analytics
BI	-	Business Intelligence
CBK	-	Central Bank of Kenya
CMA	-	Capital Market Authority
EMEA	-	Europe, Middle East and Africa
PB	-	Petabyte
PwC	-	PricewaterhouseCoopers
RBV	-	Resource-based view
SAS	-	Statistical Analysis Systems
TB	-	Terabyte

ABSTRACT

Data and subsequently information has won its place as a key resource for organizations. This is due to its ability to transform operations and aid in decision making. Big data has popularly been characterized using three Vs which are high volume, velocity and variety. Big data analytics (BDA) allows organizations to derive insights from the enormous multi-structured data that they store. The Kenyan financial sector is quite competitive and banks have for a long time enjoyed dominance in that industry. However, the entrance of fintech companies that are using technology to offer similar services has caused a stir in the industry and banks have moved towards adopting partnerships with the fintech companies or offering fintech products to remain competitive. The objectives of the study were to establish the extent to which big data analytics has been adopted amongst banks and fintech companies in Kenya, to establish the relationship between the adoption of BDA and competitive advantage and finally to establish the challenges and opportunities of adopting BDA. The study was carried out using descriptive research design. The population consisted of 42 commercial banks and 38 fintech companies in Kenya amongst whom a census survey was done. Data was collected using a structured questionnaire. It was then analyzed using descriptive statistics and regression analysis. Multiple regression was carried out to establish the nature of the relationship between adoption of BDA and competitive advantage. The results of the study showed only 11.5% of organization had not taken any steps towards adoption of BDA while 23.1 % were effectively using the technology. The rest of the organizations were either planning to adopt or testing their data models. The study found that adoption of big data analytics leads to significant achievement of competitive advantage. It had also enabled the organizations that were effectively using BDA to come up with new products and enter new markets. It was also found that the organizations studied faced various challenges in the adoption of BDA, some of which were integration of legacy systems with new technologies and poor quality of data. Adoption of BDA presented the organization various opportunities which could be exploited some of which were improving customer service, fact-based decision making and operations management. Further research needs to be undertaken on the adoption of BDA in other areas of the financial sector and to also establish the impact of the adoption on financial performance.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Big data can be termed as the new oil for the 21st-century organizations in terms of the potential value it can create for them. Through data mining, valuable insights can be derived by analyzing the enormous data sets collected by organizations. However, the importance of big data is embedded in what they do with other than the volume of data an organization holds. Data analysis can be used to discover trends and patterns which can be interpreted to improve effectiveness and efficiency across an organization's operations resulting in a better competitive index of the business.

The big data movement has been propelled by the increasing growth of unstructured, semi-structured and structured data in the recent past coming from various sources such as text files, social media, remote sensors, mobile devices and many other sources. Today, data is growing at a faster rate than ever witnessed before. For instance, it is estimated that 300 million new photos are uploaded on Facebook per day while 300 million Instagram users share sixty million photos per day. About one hundred hours of video are uploaded on YouTube per minute (Isah, 2015). Advanced analytics technologies have been developed to analyze such kind of data and deduce interesting findings which are informing decisions making in businesses. BDA is therefore a powerful disruptive technology that businesses in today's competitive environment can no longer afford to ignore.

The term big data has been defined differently by different people. Some people have referred to big data as a buzzword and an obscure concept that has failed to reach wide adoption in sectors that are not primarily technological or driven by data (Kim, 2014). It is not uncommon for a company to customize their definition of big data. What is needed is for every organization to define what big data means to them. They need to understand what it can do for them and the potential it holds for them. Some people perceive big data as this big and scary phenomenon that is out of their control. However, as powerful as big data may be, it can be controlled positively and used to provide useful insights into the business and create value. To ensure that a company is moving in the right direction as far

as big data is concerned, it is necessary to ensure company heads in the c-suite support big data initiatives. After that, there needs to be a positive culture change in the lower cadres of the organization to ensure everyone supports big data use (Arthur, 2013).

Competition in the Kenyan banking quite high just as is the case in other sectors of the economy. According to Jaya (2018), banks and fintech companies are increasingly adopting big data analytics (BDA) as a core strategy to differentiate themselves from the competition. Many Kenyan banks have embraced technology to increase efficiency and lower operational costs. For instance, the number of automated teller machines (ATMs) has continued to increase every year (Ombongi & Long, 2018). In addition, many banks have adopted data analytics to strengthen risk management in areas such as fraud detection and credit scoring. Analytics is helping financial institutions identify factors that lead borrowers to default on a loan payment and they are coming up with programs to mitigate those factors (Shukla, 2018).

Adoption of big data across the African financial sector is on the rise. Kenya is setting the pace in Africa on the usage of BDA. The country has become a center for business opportunities through the use of digital currency and usage of mobile phones for financial transactions. Seventy two percent of Kenya's and Tanzania's population uses mobile banking. The high usage generates a lot of data that is later used to assess the customers' credit score before they can be given loans. In addition, Nedbank from South Africa has allowed its corporate merchants to access its data on customer’s spending patterns and this has increased the bank’s profitability significantly (Shukla, 2018).

Theories that relate to adoption information systems were used to guide this study. The theories that were studied include the Technology Acceptance Model (TAM), Schumpeter's theory of innovation and the Resource-Based View (RBV). These theories helped in explaining, understanding and even predicting the phenomena under discussion in the study.

1.1.1 Big data analytics

Big data is defined as the combination of data collected from a combination of digital sources and traditional sources both from within and outside an organization which can be analyzed to draw useful insights for the organization (Arthur, 2013). The term big data often refers to the kind of data whose type and size is beyond the ability of traditional databases to collect, store and analyze. The data comes from various sources such as social media interactions, web behavior, remote sensors, business transactions, audio and video sources as well as different devices connected to the internet.

Big data analytics allows business analysts and researchers to make fact-based decisions by using data which was previously unusable or inaccessible. Some of the techniques used to unearth value from this data include predictive analytics, machine learning, text analytics and natural language processing. Analysts can use this data either independently or in combination with their organizational data to help them arrive at new insights that are used to make better decisions (IBM, 2018). The use of data to make decisions therefore eliminates the risk of using intuition or gut feeling to make wrong decisions which can be very expensive for a business.

Big data was initially characterized by elements popularly known as 3 Vs which are variety, volume and velocity. The volume aspect refers to the enormous amount of data while velocity points to the high speed with which data is transferred. Lastly, variety means that the data is of different types and could range from images to videos to text. However, with the growth experienced over the years, the number of Vs increased to four elements when Oracle added Veracity which refers to the quality of the data. Statistical Analysis Systems (SAS) added Variability (ability to differentiate important data from noisy data efficiently) and Complexity (ability to figure out changes in data as compared to existing data) thus coining the 4Vs and 1C of big data.

Banks usually get lots of information from different sources and this requires them to come up with innovative ways of managing this data. Some of this information may be from customer transactions, customer profile data, browsing history from their website visitors and also from social media interactions with clients. Using this data, marketers can use data

analytics to achieve their targets with more effectiveness and efficiency as a result of understanding their customers' needs (Evry, 2015).

There are various use cases for big data in the financial sector. For instance, sentiment analytics can be used to go through volumes of communications about a financial institution's products and services and provide a summary of customers' preferences. Secondly, data analytics can be used to develop a 360-degree view of a customer by analyzing a customer's lifestyle. Data analytics can also an institution to develop sharper customer segments more efficiently. BDA can also help financial institutions in determining the next best offer because it enables them to predict what a customer will demand next. Lastly, BDA gives financial institutions the ability to effectively manage their channels by analyzing their customer's channel journey (Evry, 2015).

1.1.2 Competitive advantage

According to Porter (1985), competition plays a big role in the success or failure of any given business. He defines competitive advantage as the favorable position held by an organization that allows it to be more profitable than its rivals in the same industry. It grows out of the value that a firm creates for its clients. Organizations can adopt either a defensive or an offensive competitive strategy to deal with the five competitive industry forces. These forces include the bargaining power of buyers, the bargaining power of sellers, the threat of substitute goods, the threat of new entrants and lastly industry rivalry among competing firms.

There are three generic strategies of dealing with the above competitive forces. The Cost leadership strategy involves tight control on costs so that an organization can produce at lower costs than its competitors. It is expected that by lowering costs, the firm can earn higher profit margins. The differentiation strategy involves creating products or services that can be considered unique in the industry. This strategy allows a firm to earn above average returns because it creates a defensible position for the firm against competitive rivalry and also creates customer loyalty. The focus strategy is made up of 2 variants which are differentiation focus and cost focus. This strategy, in general, involves focusing on a narrow segment and serving it extremely well. The cost focus variant seeks to gain cost

advantage in its target segment. On the other hand, the differentiation focus seeks to establish differentiation in its target niche. (Porter, 2008)

Competitive advantage for financial institutions can be measured using financial and non-financial measures. The financial measures used are annual profit, Return on Equity (ROE) or Return on Assets (ROA). Non-financial competitive advantage can be measured using service quality, cost effectiveness, achievement of organizational core competence and responsiveness to customer needs (Harada & Mdnoor, 2017).

Over the last few years, the financial services sector has experienced a major disruptive force – fintech (financial technology). Fintech can be defined as the mode of offering improved financial services through technology. Fintech companies are using big data to compete against mainstream banks. For instance, through data mining of both internal and external data, they are able to build risk profiles of their customers which helps them to reduce bad debts from loan defaulters. Fintech companies have also come with new models of operations. For instance, some are operating as digital banks e.g Openbank and Atombank that are offering customers online banking (Nanduri, 2017). These developments are causing a major transformation in the banking industry. Fintech companies have an advantage over banks in that they do not have the burden of legacy systems which add to the complexity of integrating big data and traditional data (Mastercard Foundation, 2018).

1.1.3 Commercial banks and fintech companies in Kenya

The banking industry in Kenya is vast; it comprises of forty two banks, a mortgage finance institution and several microfinance. The Central Bank of Kenya (CBK) regulates these institutions (Central Bank of Kenya, 2017). Commercial banks categorized into three tiers which are large banks, medium banks and small banks. The large banks have the largest market share; they take more than half of assets, deposits, bank accounts and shareholder's funds held by all the other medium and small banks (Ombongi & Long, 2018).

There are 38 Fintech companies in Kenya (Mesropyan, 2017). Kenya has the highest number of Fintech companies in Africa. This can be attributed to the high penetration rate of mobile phones and the receptivity of technological innovations. MPESA has particularly created a stimulus for the establishment of fintech businesses. Fintech companies offer

different services such as mobile banking, mobile payments, mobile lending and savings, mobile-based fundraising platforms, insurance agency, international remittance services, online blockchain and procurement platforms, online payments platforms, peer-to-peer lending and payments solutions, business-to-business lending and payments solutions, online trading and online forex bureaus (Sejpal & Rebelo, 2018). Fintech institutions are also regulated by the CBK although they are pushing for the establishment of their own regulatory authority. Fintech companies that require to set up their own telecommunication systems additionally require licensing by the Communications Authority of Kenya (CA).

1.2 Research problem

Financial institutions are of great economic importance in the national development and this is a major factor that drives their efforts in developing various frameworks for gaining competitive advantage. These institutions strive to own resources that will help them gain an edge in a competitive market (Harada & Mdnoor, 2017). Financial institutions, just like many other organizations are now leveraging on innovative technological solutions for competitive advantage. One such innovation is big data analytics. Banks and fintech companies are using analytics to gain an edge for themselves in the midst of cutthroat competition by using data in major decision making areas such as cost control and risk mitigation (Daruvala, 2013).

Research shows that adoption of BDA by different industries is on the rise. The Dresner Advisory Services firm in 2017 conducted a market survey on end-user trends and intentions on BDA across different organizations globally. According to report, telecommunications and financial services firms emerged as the leading adopters of BDA. The study found that 53% of companies have adopted BDA up from 17% in 2015. By region, North America leads adoption with 55% while EMEA (Europe, the Middle East and Africa) follows closely with 53%. The Asia-Pacific region took third place with 44% current adoption (Columbus, 2017).

In Kenya, the influence of Fintech started attracting attention in 2016 when the Capital Market Authority (CMA) signed a Co-operation agreement with the Australian Securities and Investments Commission (ASIC). The aim was to promote innovation in financial services in the respective countries. As a result of the agreement, Kenya has managed to

leverage itself as a center for innovation in Africa. Although Kenya leads in Fintech in Africa, at a global level the country lags behind. For instance, China emerged the global winner in the KPMG Fintech 100, a survey that ranks global top 100 fintech companies. GrassRoots Bima, an insurtech company which provides innovative and inclusive mass market insurance, emerged number 76 in the same survey (CIO , 2017). In addition, Kenyan fintech companies lag behind their United States counterparts in attracting investors (Kasyoka, 2017).

Many banks in Kenya have invested heavily in technology. For instance, Equity Bank currently disburses about 93% of their loans through mobile phones. The bank also hopes that upon completion of their integration with the national registries, 95 percent of their accounts will be registered using mobile phones. However, many financial institutions in East Africa are still at the stage of exploring whether there is value in huge datasets obtained from mobile devices, e-commerce transactions, business operations and social media. They are still at the point of testing models that can, for instance, be used to predict a customer's willingness to pay back a debt (Mastercard Foundation, 2018).

The studies done previously by Ndambo (2016), Nderi (2014) and Mbaluka (2013) have focused on the usage of big data in banks and insurance companies and not on fintech companies which are now providing the same services as banks but using different business models. The study by Nderi (2014) focused on business analytics which relies heavily on human intervention while this study is on big data analytics which heavily relies on technology. Ndambo (2016) recommends that a study be done on the impact of BDA in other sectors of the Finance industry. The research question of this study is: what is the impact of adopting of BDA on the competitive advantage of banks and fintech companies?

1.3 Research objectives

The overall objective of the study was to establish the extent of adoption of big data analytics by commercial banks and fintech companies in Kenya.

The specific objectives of the study were to:

a) Establish the extent to which commercial banks and fintech companies in Kenya are using BDA
b) Determine the relationship between BDA adoption and competitive advantage
c) Establish the challenges faced and opportunities of adopting BDA

1.4 Value of the study

Findings of the study will be very valuable to financial institutions that are considering adopting big data analytics. It will give insights into what other players in the industry are using and the benefits being realized from the adoption of BDA. It will also highlight the most common challenges that are being faced in the adoption so that those who intend to take up BDA can come up with ways to mitigate them beforehand. In addition, the paper will be resourceful to technology-based companies providing big data analytics services to other businesses and also to individual customers. It will provide insights into popular areas where companies need data analytics services.

Secondly, the study will enrich further the academic knowledge repository on current practices and trends with regards to big data adoption in the financial sector in Kenya. It will provide data on the extent of adoption of big data analytics by banks and fintech companies, the benefits, the challenges they face as well as the opportunities that BDA offers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter analyzes theories that are commonly used to inform practices regarding the adoption of information systems. In addition, popular technologies used in big data are explored. Lastly, benefits and challenges faced in the implementation of BDA are discussed.

2.2 Theoretical review

2.2.1 Technology Acceptance Model (TAM)

The TAM, as published by Davis (1989) , attempts to explain factors behind the acceptance and use of new technology or information system by users. The model proposes that 2 factors, namely perceived ease of use and perceived usefulness, determine the behavior behind computer usage. Perceived usefulness refers to the user's perception that using a certain technology will improve their life or performance at work. Perceived ease of use refers to the degree to which the user believes the new technology will be effortless. These two factors are affected by external influences which include political, cultural and social factors. Some of the social influences may include skills, language and favorable conditions. Political influencers, on the other hand, include effect of using technology in political environments. Behavioral intention measures the likelihood of a user employing an application. Attitude to use seeks to assess a user's desirability of employing the application (Davis, 1989).

In this study, if users in banks and fintech companies perceive BDA as useful or being able to help them work more effectively and efficiently, then, the rate of adoption will be higher and vice versa. Similarly, if they perceive BDA as being easy to use, the extent of adoption will also be high.

2.2.2 Schumpeter's theory of innovation

Schumpeter's theory suggests that business innovation is the major cause of economic dynamics. Innovations can be defined as new combinations. The theory proposes that consumer's needs are innate; not spontaneous and as such cannot cause economic change. The theory asserts that the role of consumers is a passive one during an economic disruption. Schumpeter's (1934) theory of economic development describes development as a historical process of structural changes that is driven by innovation.

Schumpeter identifies five types of innovation. They include the development of new products; the use of new production methods; entering new markets; acquisition of new supplies of raw materials and development of new industry structures. He divides innovation into four types: invention, innovation, invention, diffusion and imitation. He further argued that organizations that seek to be profitable have to innovate as this leads to competitiveness. He believed that innovation causes creative destruction in economic development. The dynamic entrepreneur draws upon the innovations of scientists to create new opportunities for investment (Śledzik, 2013).

In this study, BDA can be viewed as an innovation while companies that have adopted BDA are the entrepreneurs. These entrepreneurs are using BDA as a tool of innovation to achieve competitive advantage by creating new markets and changing business processes for efficiency gains.

2.2.3 Resource-based view

The resource-based theory (RBV) proposes that organizations that own strategic resources have superior competitive advantage over those that do not. Resources that can easily be acquired by competitors cannot be considered as a source of sustainable competitive advantage. Strategic resources must possess the characteristic of valuable, rare, not easily substitutable by competitors and inimitable (University of Minnesota, 2010).

A resource is considered valuable if it helps a business capitalize on its strengths and counter threats. A rare resource is held by few or no competitors at all. Legally protected intellectual property such as patents and copyrights can be considered inimitable. A resource fits the non-substitutable characteristic if competitors cannot combine their resources to gain the same way as the resource bundle of a certain organization (University

of Minnesota, 2010). A company that owns a resource that has all the four characteristics is able to gain a sustainable competitive advantage.

The RBV theory provides useful insights on how financial institutions can gain sustainable competitive advantage using their unique data sources. They can combine their unique internal data and selected external data to get unique insights that cannot be matched by competitors. They can also acquire the most competent data analysts in the market who are able to combine business acumen and data science to give the firm unmatched insights.

2.3 Empirical studies

According to the PriceWaterhouseCoopers (PwC) Global Fintech report (2017), mainstream financial institutions are increasingly adapting to the disruption caused by fintech through partnerships with fintech startups instead of competing with them. The survey was carried out amongst 1308 financial services and fintech senior executives in 71 countries and across 6 regions in 2017. The survey found that about 80 percent of mainstream financial institutions feared losing part of their business to standalone fintech institutions. Seventy four percent of respondents rated data analytics as the most relevant technology they were planning to invest in the next one year. This was followed closely by mobile technology at 51 percent and artificial intelligence at 34 percent. Respondents expected 20 percent ROI on fintech projects. Over 50% of the respondents cited that data storage, privacy and protection were the main challenges to innovation. PwC advises that financial institutions that want to remain competitive must make their innovation strategy a key part of their overall strategic plan.

Capgemini Consulting (2014), conducted a study on how banks can gain by analyzing their customers' data across North America. Findings of the study showed that 60 percent of financial institutions surveyed believed that data analytics offered significant competitive advantage. Over 70 percent of the banking executives agreed that customer centricity was important to them and were relying on big data to achieve it. In sharp contrast, only 37 % of customers believed banks understood them. The study also found that only 37 % of commercial banks have practical experience in implementing big data technologies and that the most of them were still at the piloting stage.

Indian Banks are making efforts to catch up with their international counterparts in the area of BDA even though a lot of scope remains. A study was carried out in 2016 on what Indian banks can learn from best BDA practices by other banks globally. The objective of the study was to assess how Indian banks were using data in areas such as fraud management, customer profiling, channels usage, feedback analysis, tracking customer spending and product cross-selling. Secondary data from a certain bank in the Middle East was used. The study found that data analytics was being used in different banking operations to help the institution deliver better services to customers. The study recommends further research to link financial and non-financial benefits to implementation of data analytics in the given bank (Srivastava & Gopalkrishnan, 2015).

A study was carried on the interdependences and contextual factors that affect adoption of big data analytics in Germany amongst 138 companies (Schüll & Maslan, 2018). It was based on the technology, organization and environment framework. The main objective of the research was to establish the factors that influenced BDA adoption. The study found that technology was not amongst the most important internal factors that influenced adoption. However, BDA skills and internal data usage were the most influential factors. Other factors that were found to be significant were environmental factors such as competition and market pressure. However, the study found no link between BDA adoption and firm performance which could be explained by recency of BDA investments. The study suggests that a study is carried over time to establish the influence of BDA on firm performance.

A Kenyan study on the influence of big data on business value of banks in Kenya was carried out by Mbaluka (2013). The main objective of the study was to find out the level to which banks were using big data tools. The target population was 43 banks licensed by the CBK. According to the study, 48 percent of respondents had no big data management initiatives underway while 23 percent were seriously planning for data analytics. Only 29 percent had initiatives in operations. Structured data dominated as a source of information. Banks with high asset values had invested more in big data which indicates they expected good returns on their investment. The study recommended that banks needed to understand

their short-term and strategic information needs and develop a roadmap of which big data technologies will help them achieve these needs (Mbaluka, 2013).

Nderi (2014) conducted a research on the usage of business analytics and its effect on performance of banks in Kenya. The objective of the research was to determine the areas in which banks were applying business analytics and the factors driving the adoption. A census survey of the 44 banks operating in Kenya then was conducted. The researcher conducted regression analysis to assess the impact of business analytics on performance. The study found that business analytics was key to performance. Upon carrying out multiple regression analysis, the study found that there was a positive relationship between the use of business analytics and the performance of banks.

Ndambo (2016) conducted a research on BDA and competitive advantage of banks and insurance companies operating within Nairobi. The objective of the study were to establish the level to which targeted companies were using big data. It also sought to determine the relationship between BDA and competitive advantage of the respondents. A sample of 20 commercial banks and 25 insurance companies was used. The study found that a big number of respondents were using BDA for various purposes such as predictive analytics, fraud detection and data querying. Overall, the study found that many of the institutions surveyed were at their early stages of adopting big data. Inferential analysis revealed that BDA adoption accounted for 60 percent of the respondents' competitive advantage. One of the recommendations of the study was that banks and insurance companies needed prioritize BDA investments and adopt the test and learn mentality to help them determine how fast and deep to go in adopting business intelligence (Ndambo, 2016).

2.4 Benefits of adopting big data analytics

A study done by Mbaluka (2013) on big data management and business value amongst commercial banks in Kenya identified various benefits realized from big data management such as improved customer experience, new product innovations, reduced risk and fraud, more efficient operations and real-time decision making. In addition, Ndambo (2016) identified several benefits when BDA was applied by banks and insurance companies and these include more customer focused strategies, customer service efficiency and greater

differentiation from competitors. Srivastava & Gopalkrishnan (2015) add that BDA was helping banks in India improve their active and passive security systems.

2.5 Challenges and opportunities of adopting big data analytics

The adoption of BDA comes with its own share of challenges. According to Ndambo (2016), the most common challenges faced by banks and insurance companies when implementing BDA were in the areas of speed of data processing, regulatory requirements, data access, data security and lack of trained data analysts. Mbaluka (2013) also identifies other challenges such as privacy issues, difficulty in information access and sharing (silos), varying characteristics of big data and difficulty in analyzing new data types. Other challenges identified include time taken to analyze huge data sets, lack of top management support and the high cost of storing and analyzing the data (Coumaros, Buvat, & Auliard, 2014).

On the positive, the use of BDA offers institutions the chance to become smarter organizations in a number of ways. First, it can help a company cut on costs by enabling them identify areas of wastage and achieve efficient business processes. In addition, by adopting technologies such as Hadoop and in-memory statistics, organizations can greatly improve their speed and accuracy of decision making. Another opportunity is the ability to develop new products which is enabled by ability to gauge customer needs through analytics (SAS, 2016).

2.6 Big data technologies

BDA is not encompassed in a single technology. Usually, several technologies work together to help analysts get value from the data they process. With technological advancements, more sophisticated tools continue to be developed. A few popular technologies will be discussed to help appreciate what goes on behind the scenes and the magnificent dashboards that provide end users with the data they need at a glance.

To start with, Hadoop has gained a lot of popularity because of its effectiveness in distributed storage and processing of data. Hadoop is an open source software framework used by organizations to store very enormous amounts of data in cloud environment (SAS, 2016). Hadoop became popular due to its scalability and reliability. By using distributed computing, the platform significantly increases processing speed.

Secondly, predictive analytics encompasses a combination and hardware solutions that can be used by firms to develop predictive models that are used to forecast the future based on historical data. (Press, 2016). Predictive analytics is very helpful in helping businesses make decisions in areas such as marketing, risk mitigation, fraud detection and operations improvement.

In addition, NoSQL databases are a new evolution of databases which unlike the traditional relational databases do not require tabular relations. NoSQL databases are popularly used in big data and real-time web applications to process multi-structured data (MongoDB, 2018).

In-memory analytics is a technology that analyzes data from within the system memory other than from the hard disk thus making it possible to extract immediate insights which can be acted on quickly. It makes it possible to remove latencies caused by data preparation and analytical processing when testing scenarios and also when creating new models. It allows organizations to stay agile and to also run iterative and interactive analytics scenarios (SAS, 2016).

Text mining is a technology that involves the analysis of text data. The data may be from various sources such as the web, books, comments sections etc. the data is analyzed to unearth insights that can be missed by the bear eye. This technology makes use of natural language processing and machine learning to analyze huge chunks of text. It can be used to derive new term relationships and topics from emails. Twitter, blogs and surveys (SAS, 2016).

Data mining technology is used to examine huge amounts of data to discover hidden patterns therein. The patterns discovered can then be used to solve complex business problems. Data mining had been around for some time now. Data mining tools help an analyst to sift through noisy data and pinpoint what they need and make decisions faster (SAS, 2016).

2.7 Conceptual framework

Figure 1 represents the conceptual framework used in this study. It shows the relationship between application of BDA in financial institutions and the expected gain which gives the adopter a competitive advantage.

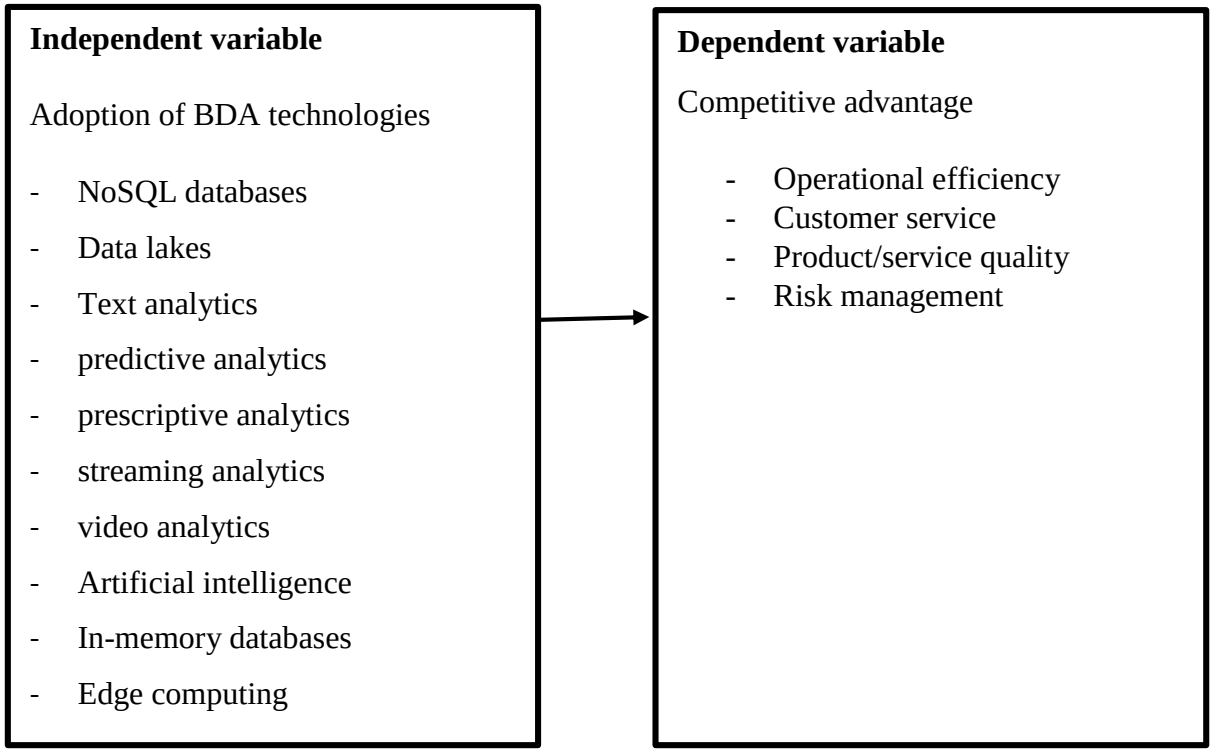

Figure 1: Conceptual Framework

Source: Author (2018)

2.8 Summary of literature review

From the literature studied, it can be concluded that financial institutions are aware of the need to adopt big data technologies. It is however noted that many of them have remained the testing stage for so long. The study therefore sought to understand what those who have adopted big data are using it for, the benefits and the challenges faced in the adoption.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the research design used in the study. It also explains the population the study focused on. In addition, it explains the methods used to collect and analyze data.

3.2 Research design

The study used a descriptive research design. This type of research design allows the researcher to describe the current status of a given phenomenon (AECT, 2001). The choice was informed by the fact that this design was suitable for the purpose of establishing the relationship between the adoption of data analytics and competitive advantage of financial institutions.

3.3 Population and sample design

The population of this study comprised a total of 80 institutions comprising of 42 commercial banks and 38 fintech companies that were operating in Kenya as at October, 2018. A census survey was done due to the small number of total institutions.

3.4 Data collection

A structured questionnaire was used to collected data. The questionnaires for various institutions were administered using drop and pick later method as well as through online platforms such as email. The questionnaire was administered to IT managers in the each of the targeted companies since as it was expected that they have oversight in the implementation of BDA. The questionnaire had 4 sections. Section 1 covered profiles of the respondents and their organizations. Section 2 covered areas in which the targeted respondents were using big data. Section 3 covered sought to assess the benefits of implementing BDA. Section 4 was on the opportunities and challenges faced in implementing BDA technologies.

3.5 Data analysis

The background data was analyzed using frequencies and percentages. Data that was collected for objective one on the extent of adoption of BDA was analyzed using means and standard deviation. Objective three was achieved by finding means and standard

deviations for the data on challenges. Data on the opportunities was analyzed using coding and finding frequencies of the various categories. Data collected for objective two which was to find the relationship between the extent of adoption of BDA and competitive advantage was analyzed using regression as per the formula:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \cdots + \beta_{12} X_{12} + \varepsilon$$

Where:

Y = competitive advantage

β_0 = constant

X_1 = noSQL databases

X_2 = data lakes

X_3 = Text analytics

X_4 = predictive analytics

X_5 = prescriptive analytics

X_6 = streaming analytics

X_7 = video analytics

X_8 = in-memory databases

X_9 = artificial intelligenc

X_{10} = blockchain analytics

X_{11} = natural language processing

X_{12} = edge computing

ε = error

$\beta_0, \beta_1, \beta_2, \ldots, \beta_{11},$ =regression coefficients

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

In this chapter, the analysis of the data that was collected is presented as well as the results of the analysis. It also covers findings on background information of respondents and organizations. In addition, it presents findings on extent of adoption of data analytics by the targeted institutions and the benefits realized by adopting BDA. It also covers regression analysis that is performed to establish the nature of the relationship between adoption of BDA and competitive advantage of banks and fintech companies. It also covers the various benefits as well as challenges faced by the institutions as they adopt big data analytics. The chapter will also discuss findings in comparison with similar studies.

4.2 Response rate

This study was carried out using a census survey of 42 commercial banks and 38 fintech companies that were operating in Kenya at the time of the study. The targeted respondents were IT managers involved in data analytics in their organizations. A total of 52 institutions responded comprising of 28 banks and 24 fintech companies. This resulted in 65% response rate.

4.3 Demographics

The study required respondents to identify the type of organization they worked for. In Table 1 a summary of the respondents by type of organization is presented.

Table 1: Type of organization

Organization Type	Frequency	Percent (%)
Bank	28	53.8
Fintech	24	46.2

Source: Author, 2018

Majority of the respondents were aged 40 years and below as shown in Table 2. This represents a fairly young population. Only about 4% were above the age of 40 years.

Table 2: Distribution of respondents by age

Age bracket (Years)	Frequency	Percentage
20-30	21	40.38
31-40	29	55.77
41-50	2	3.85
Total	52	100.00

Source: Author, 2018

Table 3 presents how long organizations had been operating. There was a relatively big number (36.54 %) of organizations that had existed for up to 10 years and this was followed closely by those that had been in operation for between 11 and 30 years at 34.62%. Generally, most fintech, were younger compared to banks which could be explained that the financial technology was a fairly new phenomenon in Kenya.

Table 3: Distribution of organizations by age

Years of operation	Frequency	Percentage
0-10	19	36.54
11-30	18	34.62
31-50	10	19.23
50-100	5	9.62
Total	52	100.00

Source: Author, 2018

The survey sought to assess the value of business assets owned by the organizations studied. The results are as shown in Table 4. Generally, it was found that fintech companies had less worth of business assets than banks. This could be attributed to restrictions by the prudential guidelines of the Central Bank of Kenya which requires banks to have a minimum amount of Ksh 1 billion core capital. On the other hand, financial institutions were required to have a minimum core capital of Ksh 200 million (Central Bank of Kenya, 2013) .

Table 4: Business assets

Business assets (Ksh)	Frequency	Percent
Below 0.5 billion	9	17.3
0.5 - 1 billion	7	13.5
1- 5 billion	11	21.2
6-10 billion	2	3.8
Above 10 billion	23	44.2
Total	52	100.0

Source: Author, 2018

4.4 Adoption of big data analytics

To meet the first objective of the study which was to establish the extent of BDA adoption, the following were assessed: size of data held by organizations, the stage where organization were in the adoption of BDA, data sources, percentage of data analyzed and the extent to which various BDA technologies were being used.

4.4.1 Amount of data stored

Table 5 shows the amount of data stored by banks and fintech companies. The survey found that no bank held data in the category of below 1 terabyte (TB). This can be attributed to the fact that banks run thousands of transactions every day. Majority of banks had data ranging between 1 TB and 100 TB. Only 17.9 % of banks has data in excess of 1 petabyte (PB). Unlike banks, a number of fintech companies (20.8%) had data below 1 TB. This is likely for startups that usually have thin client files. A majority (62.5 %) of fintech companies had data ranging from 1 TB to 100 TB. Only a small number (4.2 %) had more than 1 PB of data.

Table 5: Amount of data stored by organizations

Type organization	Size of data	Frequency	Percent
	1 TB- 100 TB	13	46.4
	100 TB - 1PB	10	35.7
	Above 1 PB	5	17.9
Bank	Total	28	100.0
	Below 1 TB	5	20.8
	1 TB- 100 TB	15	62.5
	100 TB - 1PB	3	12.5
	Above 1 PB	1	4.2
Fintech	Total	24	100.0

Source: Author, 2018

4.4.2 Extent of adoption of big data analytics

Only 23.1 % of respondents were effectively using BDA as shown in Table 6. The largest proportion (26.9%) were at the stage of planning adoption and this was followed closely by 21.2 % of the population who were at the testing stage. A relatively small number (11.5%) were not started yet.

Table 6: Extent of Adoption

Extent of BDA Adoption	Frequency	Percent
Not started	6	11.5
Considering adopting	9	17.3
planning adoption	14	26.9
testing/piloting	11	21.2
Effectively using BDA	12	23.1
Total	52	100.0

Source: Author, 2018

4.4.3 Duration of big data analytics usage

The study sought to assess how long organizations had been using BDA and the results are as shown in Table 7. For the organizations that were effectively using BDA, the maximum

usage period was 10 years while the minimum usage period was 3 years. On average, these organizations had been using BDA for close to 5 years.

Table 7: Duration of BDA usage in years

N	Mean	Mode	Std. Deviation	Minimum	Maximum
12	4.75	5	1.815	3	10

Source: Author, 2018

4.4.4 Types of data analyzed

The survey asked respondents to select the kind of data they analyzed in their organizations. The results are shown in Figure 2. The top five types of data analyzed were transactions, log files, social media, emails and telephone calls. The least used sources of data were clickstream, sensors and geospatial data and this could probably because banks and fintech companies are in the financial services sector which has little use for these kinds of data.

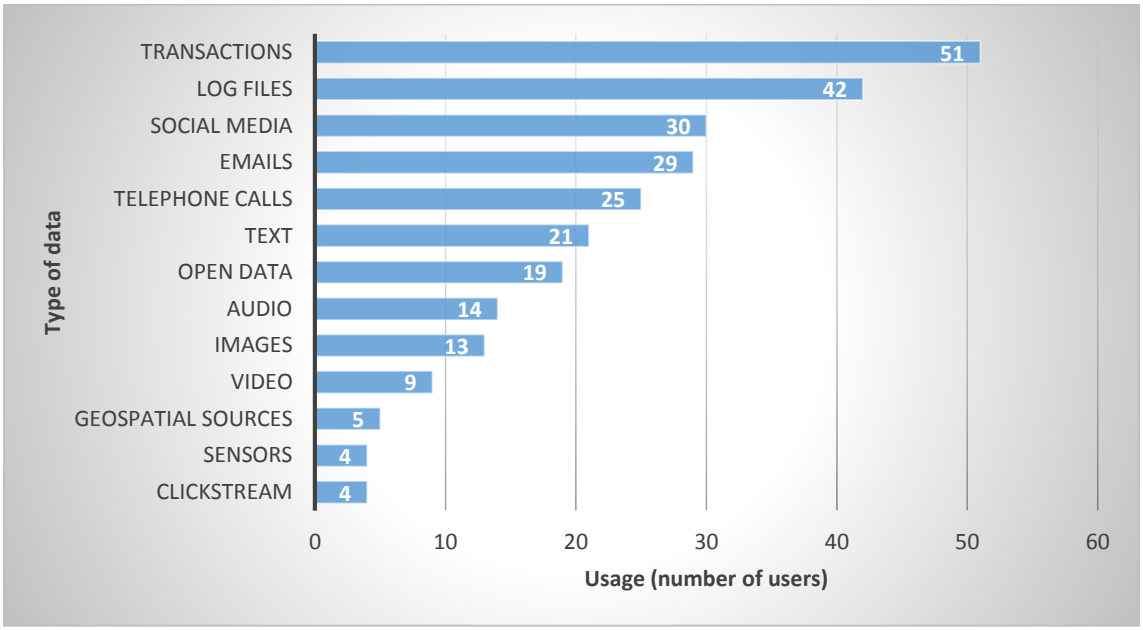

Figure 2: Types of data analyzed

Source: Author, 2018

4.4.5 External data and amount of data analyzed

This section sought to find out the percentage of data sourced externally by banks and fintech companies. Sixty percent of banks and fintech companies sourced less than 40 %

of their data from external sources. Generally, there was limited use of external data which can be attributed to the fact that financial institutions are skeptical of the accuracy of the external data and most find their internal data much more reliable for modelling various algorithms such as customer profiling. Most of them for instance only use credit reference bureau data to make the first initial lending decision which is usually of a low amount. (Mastercard Foundation, 2018)

Table 8: Percentage of data sourced externally

Percentage of data sourced externally	Frequency	Percent
0- 20 %	15	28.8
21- 40 %	16	30.8
41- 60 %	7	13.5
61- 80%	11	21.2
81-100%	3	5.8
Total	52	100.0

Source: Author, 2018

The study also sought to establish the amount of data held by organizations that is analyzed. The results are shown in Table 9. The distribution of the data analyzed was almost even for between 0 – 80 % but quite low for the 81-100 % category. This implies that there is still unexploited potential in the data held by organizations.

Table 9: Percentage of data analyzed

Percetage of data	Frequency	Percent
0- 20 %	13	25.0
21- 40 %	14	26.9
41- 60 %	12	23.1
61- 80%	12	23.1
81- 100%	1	1.9
Total	52	100.0

Source: Author, 2018

4.4.6 Usage of big data technologies

The study sought to establish the extent to which various big data technologies were being used in the organizations. The extent was measured on a scale of 1 to 5 represented where

1 represented no extent and 5 represented very large extent. The findings are presented in the Table 10.

Table 10: The extent to which data technologies are used in the organizations

Big data technology	Mean	Std. Deviation
In-memory databases	4.00	1.044
Artificial intelligence	3.83	.718
Prescriptive analytics	3.50	1.000
Predictive analytics	3.42	1.084
Edge computing	3.25	1.485
Natural language processing	3.17	1.267
Streaming analytics	3.08	1.311
Data lakes	3.08	1.379
noSQL databases	3.00	1.477
Text analytics	2.92	1.165
Blockchain analytics	2.50	1.382
Video analytics	2.17	1.193

Source: Author, 2018

The findings reveal that in-memory databases, artificial intelligence and prescriptive analytics had the highest usage. The least used technologies were video analytics, blockchain analytics and text analytics.

4.5 Competitive advantage

4.5.1 Benefits realized as a result of using big data analytics

The study also sought to establish the level to which the organizations realized various benefits after adopting big data analytics. The extent was measured on a scale of 1 to 5 where 1 represented no extent and 5 represented very large extent. The findings are presented in Table 11.

Table 11: Benefits realized as a result of using big data analytics

Benefit	Mean	Std. Deviation
Better customer service	4.33	.651
Faster fact-based decision making	4.17	.577
Increased sales	4.17	.937
Better customer retention	4.17	.835
Better customer profiling	4.17	.835
Cost cutting	4.08	.793
Sharper market segmentation	4.08	.900
Optimization of channels	4.00	.953
More targeted marketing	4.00	.953
Higher quality products and services	3.92	.793
More efficient operations	3.92	.793
Digitization of banking	3.83	1.337
Reduced risk	3.67	.651
Reduced fraud	3.50	.674

Source: Author, 2018

The findings reveal that the organizations realized better customer service, faster fact-based decision making, increased sales, better customer retention and better customer profiling at the highest level as a benefits of adopting BDA. The benefits with the lowest scores included reduced risk, reduced fraud and digitization of banking.

4.5.2 Relationship between big data analytics and competitive advantage

The second objective of the study was to establish the kind of relationship between the extent of adoption of big data analytics and competitive advantage. Adoption was measured based on the extent to which organizations had adopted big data technologies while competitive advantage was measured using the benefits that organizations had realized from using the various technologies. Multiple regression analysis was adopted to determine the relationship between the independent variable (adoption of big data analytics) and the dependent variable (competitive advantage). The results in Table 12 present the fitness of the regression model.

Table 12: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.669	.448	.393	.50615

Source: Author, 2018

The coefficient of determination, R^2, explains proportion of change in the dependent variable which can be explained by a change in the independent variable. The study found that there was strong relationship between adoption of BDA and competitive advantage of banks and fintech companies. The independent variables studied accounted for 44.8 % of competitive advantage while the remaining 55.2 % could be explained by other factors.

Table 13 shows the results on the analysis of variance (ANOVA). The results show that the overall model was statistically significant as supported by a p value of 0.017 which is less than the critical p value of 0.05 implying that adoption of BDA is a good predictor of the competitive advantage of the organizations studied.

Table 13: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.081	1	2.081	8.123	0.017
Residual	2.562	10	0.256		
Total	4.643	11			

Source: Author, 2018

Multiple regression analysis was performed using stepwise method in order to establish the nature of relationship between adoption of BDA and competitive advantage. Stepwise method was selected because it allows for multiple regression to be done while simultaneously removing the weakest correlated variable so that only the variables that best explain the distribution are left. The independent variable was measured using the extent (on a scale of 1 to 5) to which various big data technologies had been adopted. These variables include noSQL databases, data lakes, text analytics, predictive analytics, prescriptive analytics, streaming analytics, video analytics, in-memory databases, artificial intelligence, blockchain analytics, edge computing and natural language processing. The dependent variable, competitive advantage, was calculated as the mean of the benefits realized as a result of using the various big data technologies. These benefits included better customer profiling, faster fact-based decision making, better customer service, better customer retention, increased sales, more targeted marketing, digitization of banking, higher quality products and services, sharper market segmentation, more efficient operations, cost cutting, optimization of channels, reduced risk and reduced fraud. Table 14 shows the regression coefficients of the model.

Table 14: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.911	0.409		7.113	0
Text analytics	0.374	0.131	0.669	2.85	0.017
Excluded variables					
noSQL databases	-0.008			-.020	.985
Data lakes	-0.151			-.414	.689
Predictive analytics	0.204			.672	.519
Prescriptive analytics	0.31			1.155	.278
Streaming analytics	0.332			1.488	.171
Video analytics	0.302			1.031	.329
In-memory databases	0.172			.715	.493
Artificial intelligence	0.218			.832	.427
Blockchain analytics	0.061			.187	.856
Edge computing	0.303			1.338	.214
Natural language processing	0.088			.307	.766

Source: Author, 2018

The regression model is represented by the equation:

$$Y = 2.911 + 0.374X_1$$

Where X_1 = Text analytics

From the results on table 14, the only significant factors based on a 95% significance level was text analytics. From the results, a unit change of text analytics results in an increase in competitive advantage by 0.374 units. The excluded variables were noSQL databases, data lakes, predictive analytics, prescriptive analytics, streaming analytics, video analytics, in-

memory databases, artificial intelligence, blockchain analytics, edge computing and natural language processing. All these variables had a p value of more than 0.05 which means that they were not significant.

An independent sample t-test was run at 95% confidence interval to compare the competitive advantage of banks to fintech companies. Table 15 shows that the mean for banks (4.2551) is a just a bit higher as compared to the mean for fintech companies (3.6429).

Table 15: Group statistics

	Type of your organization	N	Mean	Std. Deviation	Std. Error Mean
Competitive advantage	Bank	7	4.2551	.68494	.25888
	Fintech company	5	3.6429	.42857	.19166

Source: Author, 2018

Table 16 shows that the p-value of test statistic is 0.109 (which is less than alpha value of 0.05) and implies there was no significant difference in the competitive advantage of banks as compared to fintech companies. We therefore read from the first row (equal variances assumed) of t-test. The p-value for under sig (2-tailed) is 0.11 which is less than the alpha value of 0.05 which also shows that there was no significant difference between the competitive advantage of the two groups.

Table 16: Independent samples T-Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	3.09	0.109	1.755	10	0.11	0.61224	0.34885	-0.1651	1.38954
Equal variances not assumed			1.901	9.913	0.087	0.61224	0.32211	-0.1063	1.33081

Source: Author, 2018

4.5.3 New products developed

The adoption of BDA had enabled organization to develop new products. Table 17 shows that the banks and fintech companies had managed to develop between one and five new products. On average, they had been able to introduce three new products.

Table 17: New products

	N	Minimum	Maximum	Mean	Std. Deviation
Number of New products developed	12	1	5	3.08	1.240

Source: Author, 2018

4.5.4 New markets

All the organizations that were effectively using BDA indicated that they had been able to enter new markets as shown in Table 18.

Table 18: New markets

Has BDA enabled your organization to enter new markets?	Frequency	Percent
Yes	12	100.0

Source: Author, 2018

4.6 Challenges and opportunities of adopting big data analytics

4.6.1 Challenges

The third objective of the study was to establish the challenges and opportunities that adoption of BDA presented. The study sought to establish the extent to which the organizations had faced challenges in the use of BDA. The findings are presented in the Table 19. The findings indicated that most common challenges amongst both types of organizations were integrating legacy systems and new technologies, working with different data types and poor quality of data. The challenges with the lowest means were availability of data, lack of top management support and lack of required infrastructure.

Table 19: Challenges in adoption of big data analytics

Challenge	Mean	Std. Deviation
Integrating legacy systems and new technologies	3.46	1.093
working with different data types	3.38	1.069
Poor quality of data	3.25	1.082
Overwhelming volume of data	3.13	1.155
Shortage of skills/talent	3.13	1.030
Privacy concerns	3.00	1.172
Data security	2.92	.967
Regulatory risks	2.88	1.182
Access rights to data	2.81	1.155
Employee resistance	2.69	1.112
Lack of required infrastructure	2.67	1.133
Lack of top management support	2.62	1.140
Availability of data	2.52	.939

Source: Author, 2018

4.6.2 Opportunities

Respondents were asked to give the top three opportunities for using data analytics in their operation or in their industry. Responses were coded and 11 dominant categories emerged. The frequencies of these categories were calculated and ordered as shown in Figure 3. Overall, the top three opportunities for use of BDA were identified as customer service, market segmentation and operation optimization.

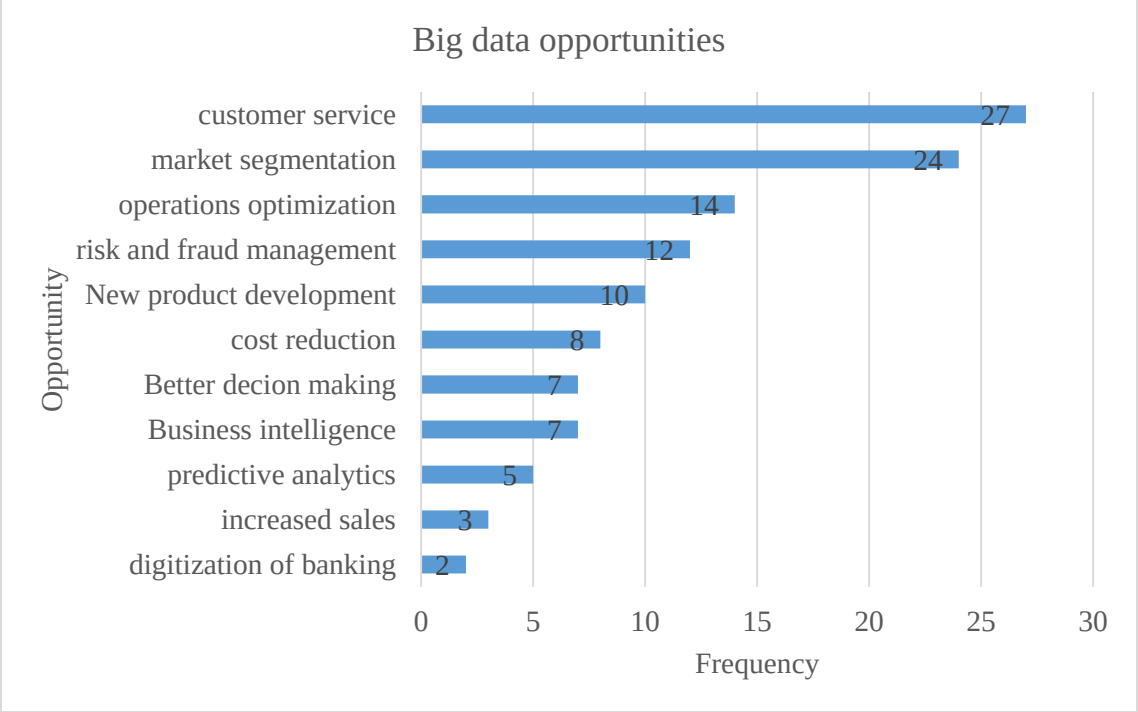

Figure 3: Opportunities for use of big data analytics

Source: Author, 2018

4.7 Discussion of results

The study found that banks and fintech companies have made steps towards adopting BDA. Only 11.5 % were not yet started. The majority were either testing models or planning adoption. The number of financial institutions effectively using BDA was still small (23%). This is in agreement with Mastercard Foundation (2018) findings that a majority of financial institutions were still at the point of testing financial models.

The study found that there was limited use of externally sourced data. About 29% of the organizations studied sourced only up to 20 % of their data from outside the organization. Fintech companies were more likely to source data from third parties due to lack of internal data on customer records such payment information. Generally, external data was used for making the initial credit decision for customers who had thin files (Mastercard Foundation, 2018). The distribution of how much data organizations exploited their data for value addition was fairly distributed between zero and eighty percent. Only about 2% of organizations analyzed over 80 % of their data.

Various big data technologies were being used with the most popular being in-memory databases, artificial intelligence and prescriptive analytics. A study by PwC (2017), indicated that 30 % of large financial institutions across the globe were investing in artificial intelligence while 77 % were expecting to incorporate blockchain into their business processes. Another popular technology was biometrics and identity management which was voted as the third most relevant technology to invest in by 43 % of fintech companies.

The adoption of BDA had helped the organizations achieve various benefits with key ones being in the area of better customer service, faster decision making and increased sales. Overall, the adoption of BDA was found to lead to competitive advantage of banks and fintech companies. A study done by Shumway & Tyler (2018) found that 75% of banking executives believed that big data capabilities were very important and 75% of them were making investments in the same. This figure is close to the finding in the study of 71.2 % of the respondents who were either planning adoption, testing or effecively implementing BDA. The study also found that there was no significnt difference between the competitive advantage of banks when compared to fintech companies.

The implementation of BDA came with its own challenges. The biggest challenges were in the area of integrating legacy systems with new systems, working with different data types and the poor quality of data. Banks that had operated for several years and were using old systems were particularly faced with challenge of integrating these old systems with new technologies. Fintech companies on the other hand faced the challenge of low quality data to a great extent because they depended on third party data to build their initial

customer profiles. The most prominent opportunities identified for the use of BDA were customer service, market segmentation and optimization of operations. A study by PwC (2017) on found that 63 % of banks were viewing the rise in fintech as an opportunity to expand their products and services. Banks were also counting on digital solutions to improve their operations and increase customer empowerment.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter discusses the summary of the study findings as well as the conclusions drawn. The chapter also discusses recommendations and limitations of the study and provides suggestions for further research.

5.2 Summary of findings

This study sought to establish the extent to which commercial banks and fintech companies were using big data analytics. This was measured using various indicators such as the stage at which organizations were in the process of adopting big data technologies, how long they had been using BDA, types of data analyzed, percentage of data analyzed and BDA technologies used. The study found that only 23.1 % of organizations were effectively using BDA while the majority (48.1 %) were at the testing and planning adoption stages. On average, the organization had been using BDA for 3 years. The most common sources of data were found to be transactions, log files, social media and telephone calls. The usage of data sourced externally was found to be limited where 60 % of the financial institutions surveyed used less than 40 % of external data. Most of the organizations indicated that they analyzed upto 80 % of the data they held. The most commonly used BDA technologies were found to be in-memory databases, artificial intelligence and prescriptive analytics.

The second objective of the study was to determine the relationship between big data analytics adoption and competitive advantage. Competitive advantage was measured using the benefits realized from adoption of BDA. The most prominent benefits were centered on better customer service as well as better decision making and increased sales. According to the study findings, BDA was found to have a positive impact on competitive advantage which implies that it was beneficial for banks and fintech companies to invest in big data as it would increase their competitiveness.

The third objective was to establish the challenges faced in the adoption of BDA and opportunities that BDA offered. It was found that the challenges assessed affected the organizations to at different levels. The biggest challenges were found to be poor quality

of data, working with different data types and integrating legacy systems with modern technologies. The top three opportunities identified by respondents as being enhanced by BDA were in the area of customer service, market segmentation and optimization of operations.

5.3 Conclusion

The study found that the adoption of BDA by banks and fintech companies had a positive impact on their competitive advantage. Therefore, these institutions can go ahead and invest in BDA as it will keep them ahead of the competition in the industry. The entrance of fintech companies has propelled the adoption of BDA in the financial services sector. Their use of technology to deliver financial services to the modern tech-savvy customers has forced banks to re-think their competitive strategies hence the reason more banks have started partnering with fintech companies and implementing fintech business models within their operations. It can only be expected that the uptake of BDA in the sector of financial services will continue to increase and will be a key differentiator in this competitive industry.

According to the study, BDA was found to be most beneficial to customer service, decision making and operations management. Since customer service is key to the success of financial institutions, BDA could be relied on to understand customer needs better which could lead to more satisfied customers. The use of BDA could enable organizations to make fact-based decisions by analyzing their historical data. On operations management, BDA could be used to identify bottlenecks in business processes, to cut on costs and to improve efficiency and effectiveness.

Respondents indicated that BDA had helped them come up with new products and enter new markets. This means that data analytics is a key element of the expansion strategies of firms as it will help them come up with new products that fit their customer needs and also venture to new market niches that may not have been possible previously.

5.4 Recommendations

Commercial banks and financial institutions that are yet to adopt to begin using data analytics should get started on this journey. Those in the piloting and planning stages should aim on getting started on effectively implementing BDA so that they can start

realizing the benefits their counterparts are getting as a result of adopting this technology. The top management of these institutions should fully support data analytics efforts by investing financially in it as it will increase the competitive index of their firms.

The adoption of BDA presented various challenges as well as opportunities. The organizations would need to come up with various mechanisms to handle these challenges. For instance, banks that had existed for many years have legacy systems that are hard to integrate with modern systems and they therefore need to embark on a transformation journey to adopt new technologies. Challenges on data volumes can be handled by adoption of cloud services that offer high scalability and faster processing speeds. To realize the highest benefits from BDA the high raking opportunity areas could be prioritized when investing in data analytics.

5.5 Limitations of the study

It was difficult getting banks to respond to the questionnaire as they do not easily share their information which is considered extremely confidential. It is also likely that some of the respondents may have been biased or dishonest especially because of non-disclosure policies in their organizations. In addition, the study's scope was limited as it only looked at banks and fintech companies and may therefore not be generalized for the larger financial services sector.

5.6 Suggestions for further research

Further research can be carried out to establish the extent of bid data analytics adoption in other sectors of the financial services sector. It would also be interesting to link adoption of BDA to financial performance of those organizations. Other studies can also be carried on the adoption of BDA in a specific firm and compared with performance of that firm over a period of time.

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APPENDICES

APPENDIX 1

LETTER OF INTRODUCTION

UNIVERSITY OF NAIROBI
SCHOOL OF BUSINESS

Telephone: 020-2059162
Telegrams: "Varsity", Nairobi
Telex: 22095 Varsity

P.O. Box 30197
Nairobi, Kenya

DATE 21/11/18

TO WHOM IT MAY CONCERN

The bearer of this letter GRACE MUKAMI MUGANE

Registration No. D61/5429/2017

is a bona fide continuing student in the Master of Business Administration (MBA) degree program in this University.

He/she is required to submit as part of his/her coursework assessment a research project report on a management problem. We would like the students to do their projects on real problems affecting firms in Kenya. We would, therefore, appreciate your assistance to enable him/her collect data in your organization.

The results of the report will be used solely for academic purposes and a copy of the same will be availed to the interviewed organizations on request.

Thank you.

UNIVERSITY OF NAIROBI
SCHOOL OF BUSINESS
21 NOV 2018
P.O. Box 30197 - 00100, NAIROBI

PROF. JAMES M. NJIHIA
DEAN, SCHOOL OF BUSINESS

APPENDIX II : QUESTIONNAIRE

Big data analytics and competitive advantage of Commercial banks and fintech companies in Kenya

Section 1

Background information

1. What is the type of your organization?

   Mark only one oval.

◯ Bank

◯ Fintech

2. What is the name of your organization? ----------

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

4. What is your age? ----------

5. How long has your organization existed (in years)? ----------

6. What is the value of your business (assets) in Kenya Shillings?

   Mark only one oval.

◯ Below 0.5 billion

◯ 0.5 - 1 billion

◯ 1- 5 billion

◯ 6 - 10 billion

◯ Above 10 billion

Section 2

Adoption of big data analytics

7. How much data does your organization have?

Mark only one oval

◯	Below 1 TB	◯	100 TB – 1 PB
◯	1 TB- 100 TB	◯	Above 1 PB

8. Extent of big data analytics adoption

Mark only one oval per row.

	Not started	Considering adopting	Planning adoption	Testing/piloting	Effectively using BDA
To what extent is your organization using big data analytics	◯	◯	◯	◯	◯

9. How long has organization been using big data (in years)? ----------

10. From what sources does your organization collect data? Select all that apply

Tick all that apply.

☐ Log files	☐ Sensors	☐ Video
☐ Transactions	☐ Open data	☐ Audio
☐ Emails	☐ Telephone calls	☐ Geospatial sources
☐ Social media	☐ Images	☐ Other ----------
☐ Clickstream	☐ Images	

11. Data usage

Mark only one oval per row.

	0-20 %	21-40 %	41-60 %	61-80%	81 100%
How much of the data collected comes from external sources	◯	◯	◯	◯	◯
How much of the data collected is exploited for the value generation	◯	◯	◯	◯	◯

12. Kindly indicate the extent to which the following big data technologies are used in your organization

Use the scale: (1) – No Extent, (2) – Little Extent, (3) – Moderate Extent, (4) –Large Extent, (5) – Very Large Extent.

	No extent	Little Extent	Moderate extent	Large extent	Very large Extent
noSQL databases					
Data lakes					
Text analytics					
Predictive analytics					
Prescriptive analytics					
Streaming analytics					
Video analytics					
In-memory databases					
Artificial intelligence					
Blockchain analytics					
Edge computing					
Natural language processing					

Section 3

Competitive advantage

13. To what extent has your organization realized the following benefits as a result of adopting big data analytics?

Use the scale: (1) – No Extent, (2) – Little Extent, (3) – Moderate Extent, (4) –Large Extent, (5) – Very Large Extent.

	No extent	Little Extent	Moderate extent	Large extent	Very large Extent
Better customer profiling					
Better customer service					
Better customer retention					
More efficient operations					
Optimization of channels					
More targeted marketing					
Sharper market					
Segmentation					
Higher quality products and services					
Increased sales					
Faster fact-based decision making					
Digitization of banking					
Cost cutting					
Reduced fraud					
Reduced risk					

14. How many new products has the use big data analytics helped your organization come up with? _____

15. Has the use of big data analytics helped your organization enter new markets?

Mark only one oval.

- ◯ Yes
- ◯ No

Section 4

Challenges and opportunities of adopting big data analytics

16. Kindly indicate the extent to which your organization faces each of the following challenges in the use of big data analytics.

Use the scale: (1) – No Extent, (2) – Little Extent, (3) – Moderate Extent, (4) –Large Extent, (5) – Very Large Extent.

	No extent	Little Extent	Moderate extent	Large extent	Very large Extent
Poor quality of data					
Availability of data					
Overwhelming volume of data					
Working with different data types					
Access rights to data					
Data security					
Integrating legacy systems and new technologies					
Shortage of skills/talent					
Lack of required infrastructure					
Privacy concerns					
Regulatory risks					
Employee resistance					
Lack of top management support					

17. What would you rate as the top 3 opportunities of big data analytics in your area of operation or industry?

APPENDIX III: LIST OF COMMERCIAL BANKS IN KENYA

1. African Banking Corporation Limited (ABC)
2. Bank of Africa Kenya Limited
3. Bank of Baroda (K) Limited
4. Bank of India
5. Barclays Bank of Kenya Limited
6. Citibank
7. Commercial Bank of Africa Limited
8. Consolidated Bank of Kenya Limited
9. Cooperative Bank of Kenya Limited
10. Credit Bank Limited
11. Development Bank of Kenya Limited
12. Diamond Trust Bank Kenya Limited
13. DIB Bank (Kenya) Limited
14. Ecobank Kenya Limited
15. Equity Bank Kenya Limited
16. Family Bank Limited
17. Fidelity Commercial Bank Limited
18. First Community Bank Limited
19. Giro Commercial Bank
20. Guaranty Trust Bank (K) Ltd
21. Guardian Bank Limited
22. Gulf African Bank Limited
23. Habib Bank Limited
24. Habib Bank A.G Zurich
25. I & M Bank Limited
26. Imperial Bank Kenya (In receivership)
27. Jamii Bora Bank Limited
28. Kenya Commercial Bank Limited
29. Middle East Bank (K) Limited
30. National Bank of Kenya Limited
31. NIC Bank Limited
32. M-Oriental Commercial Bank Limited
33. Paramount Bank Limited
34. Prime Bank Limited
35. SBM Bank Kenya Limited
36. Sidian Bank Limited
37. Spire Bank Limited
38. Stanbic Bank Limited
39. Standard Chartered Kenya Limited
40. Trans-National Bank Kenya
41. UBA Kenya Bank Limited
42. Victoria Commercial Bank Limited

APPENDIX IV: LIST OF FINTECH COMPANIES IN KENYA

1. Abacus
2. BambaPos
3. Beyonic
4. BitPesa
5. Bitsoko
6. Branch
7. Caytree Financial
8. Cellulant
9. Chura
10. ConnectAfrica
11. Direct Pay Online
12. Eastpesa
13. Eclectics International
14. Esacco
15. FarmDrive
16. Forex
17. GrassRoots Bima
18. iNuka Pap
19. JamboPay
20. Jumo
21. KCB-Mpesa
22. Kipochi
23. Kopo Kopo
24. Kwanji
25. Lakt
26. LelapaFund
27. Lipisha
28. M-Changa
29. M-Pesa
30. Mshwari
31. Musoni
32. Nomanini
33. Packline Systems
34. PesaPal
35. Remit
36. Tala
37. Tangazoletu
38. Umati Capital