BIG DATA FOR PRODUCT AND PROCESS OPTIMISATION

Abstract

Big data analytics provides organisations with an opportunity for continuously improving the performance of their products to meet the demands of the customers. The aim of this research study is to investigate how big data analytics can be used by organisations in assessing and improving the performance of their products. Using secondary data obtained from secondary sources such as books, journals, peer reviewed journals, credible websites and articles, data was collected about big data analytical and its use by organisations in assessing and improving the performance of their products. From the research findings, this research found that global companies use big data analytics to adapt to new technologies, which provide a strong basis for them to assess and enhance the performance of their products. Also, the study establishes that organisations use big data analytics to conduct research on how to optimize product and processes. Further, the study established that organisations such as real estate forms use big data analytics to enhance the performance of their products through reducing the financial risks associated with their products. Further, the study establishes that some of the challenges that organisations face in deploying and using big data analytics include difficulties in maintaining consistent and reliable data and limited knowledge and lack of a sophisticated team of IT experts and data scientists endowed with extensive knowledge on how to predict business trends. Moreover, the research findings demonstrate that big data analytics creates value to organisations through improving their sales turnover, revenue margins and growth rates; enhancing their decision making abilities and customer satisfaction levels; and helping in minimising financial risk and reducing in time wastage.

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CHAPTER ONE: INTRODUCTION

Big data analytics provides organisations with an opportunity for continuously improving the performance of their products to meet the demands of the customers. The global manufacturing sector is increasingly getting dependent on big data as products are being made based on big data models (Minelli, Chambers & Dhiraj, 2013). This change has been caused by the intense global competition, consumers that are more demanding and rapid technological advancements. Data is the backbone of any firm and as such organisations need to make use of all available information to improve their efficiency. They should be able to store, extract and utilise it in improving operations. In the past data was disconnected as there was no interconnection between systems and as such data would be stored and consumed in one place. However, the internet technology changed this as organisations are now able to acquire and share data on any issue of interest.

Organisations are expanding the role of digital technology in manufacturing and operations in order to gain competitive advantage in the global market. Big data is one of the technological innovations that is fuelling digital transformation and influencing the development, manufacture and use of products. Organisations can make use of big data analytics for continuous product innovation so that the products can meet the dynamic demands of the consumers. Therefore data should form the foundation for any organisation that aims at meeting the demands of the global market. Organisations need to collect, store, extract and utilise data in their operations in order to be able to continuously meet the demands of the consumers. This would enable them to know what is happening in the industry now, why and what is likely to happen next. With such knowledge an organisation is well placed to take the necessary steps to ensure that it positions

itself strategically to take advantage of such changes. Big data analytics enable organisations to extract important information from the big data. These analytics are capable of making predictions that enable organisations to study trends and address uncertainties that may be caused by future occurrences.

1.1 Background of the Study

The advancement of digital technology and digital devices has made it easier for organisations to generate data. Large amounts of data is being generated and stored on a daily basis. The data comes from multiple sources like social networks, messaging networks, information networks and financial systems. The data captures important information about consumer trends and the standards that they want the organisations to meet. Loshin (2013) asserts that the current world generates huge amounts of data that is readily available. The internet has made the world more interconnected and this has led to an exponential generation of data. Data is now available on different areas like weather, health, education, transport and all the other sectors. The data can readily be accessed through online services and social networks. In business, people are now making millions of online transactions using smart phones. Data is literally everywhere and this has led to an increase in the need to make data driven decisions in business (Schmarzo, 2013). Financial institutions, government, insurers, retailers and all the other organisations collect data continuously. There is an increase in the need for organisations to derive value from the big data and use it to improve the effectiveness of their operations (Loshin, 2013). Organisations can make use of this data to innovate their products and gain a competitive advantage over the other companies in the industry. The ability of an organisation to derive insights from big data determines the level of its responsiveness towards the prevailing market trends (Sathi, 2012). The value of data has not been fully utilised by many organisations, especially the smaller ones.

One of the reasons for the underutilisation is lack of time and resources to put big data to effective use. Organisations have the potential and ability to create more value out of big data but this is not happening on large scale probably due to lack of knowledge. However, this is now changing because of the developments in technological innovation. Data is rapidly changing and new technological innovations have made it possible to analyse it in an easier, faster and affordable manner (Loshin, 2013). This has made it easier to extract valuable information from the data and use it in continuously improving products to meet the dynamic demands of the customers.

Theoretically, debates about how organisations can use information technology to improve their performance has been there for long however there is no conclusive answer as to how organisations can use information technology to improve their competitiveness (Glass & Callahan, 2014). Although there is a general consensus on the importance of information technology to organisations, researchers don't agree on how the organisations can use information technology to improve their competitiveness. Some scholars have even argued that information technology cannot improve the competitiveness of an organisation since it is available to all organisations (Mayer-Schönberger & Cukier, 2013). However, these technologies have shown the ability to improve organisational performance when they are combined with the other factors that improve organisational competitiveness. Therefore organisational competitiveness depends entirely on how the organisations make use of information technology to improve their performance. From the above discussion, it is imperative that technology has numerous benefits to organisations and as such there is need to explore the ways that they can use such technology to improve the efficiency of their operations.

Owing to the fact that big data analytics is one of the latest innovations of information technology, the debate about the effect of information technology on organisational performance gets even more interesting given the immense power of the tool. Big data analytics have the potential of providing organisations with important information in a manner that was not possible a few years ago. Organisations now have access to powerful tools for analysing big data; however the connection between the tools and organisational competitiveness still remain largely unexplored. The purpose of this study is to explore how organisations can make use of big data analytics to improve the efficiency of their operations to ensure that they consistently meet the demands of the consumers. This study is focused on investigating how organisations can make use of the high volumes of data to optimise their products. It will use big data analytics to analyse various sources of customer data in order to generate insight into consumer buying behaviour, what influences their purchase decisions and how best to serve their needs. It will explore how organisations can use big data analytics to optimise their products to ensure that they consistently meet the demands of the consumers.

1.2 Problem Statement

The current business environment is fiercely competitive and organisations struggle to improve the experience of the customers, attract new ones and expand their market segments. The need to continuously improve products to meet the dynamic customer demands highlights the need for organisations to make efficient use of big data. Big data analytics provide these organisations with a framework for assessing and improving the performance of their products. Many organisations are currently experiencing problems in their quest to make efficient use of big data (Pries & Dunnigan, 2015). In addition to this, some still regard big data as catch phrase and as a result have made no attempts to use it in improving their operations. Such organisations remain

reliant on experience and intuition to make strategic decisions as they still haven't embraced the use of big data. Although big data analytics has received extensive coverage in research especially in terms of differentiating the techniques from the traditional methods, very little attention has been paid to how organisations can use big data analytics in improving their products and overall performance (Zikopoulos 2012). Some researchers like Sathi (2012), Minelli, Chambers & Dhiraj, (2013) and Ohlhorst (2013) have explored the benefits that organisations can derive from using big data analytics but very few have investigated how organisations can improve their competitiveness using big data analytics. This study seeks to highlight how the use of big data can transform the operations of an organisation to ensure that it optimises its products to meet the demands of the consumers.

1.3 Aim and Objectives of the Study

The aim of this study is to investigate how big data analytics can be used by organisations in assessing and improving the performance of their products. It will develop predictive design analytic methods that organisations can use in detecting important patterns from large scale data and combine it with the other knowledge on system optimisation used for making decisions regarding critical areas like product design, product life cycle and new product development. The research will determine how organisations can get value from big data and how the information extracted from the data can be used to improve the performance of their products. The aim of the study will be attained through achieving the following objectives:

I. To ascertain how organisations can use big data analytics to assess and improve the performance of their products

II. To identify the challenges that organisations face in deploying and using big data analytics and how can they overcome them

III. To assess the impact of big data analytics on the ability of an organisation to create value

1.4 Research Questions

The proposed study will be guided by the following research questions**:**

I. How can organisations use big data analytics to assess and improve the performance of their products?

II. What are the challenges that organisations face in deploying and using big data analytics and how can they overcome them?

III. What impact does big data analytics have on the ability of an organisation to create value?

1.5 Thesis Disposition

The rest of the study is divided into the following sections: literature review, methodology, findings, discussion, conclusion and recommendations. Chapter two reviews literature on previously published studies to ascertain the information that is already available and then identify a dearth in research that the current study aims to fill. Chapter three will explain the methodological framework that the researcher will use to attain the aim and objectives of the study. Chapter four will then present the findings of the study followed by chapter five which will provide a discussion and analysis of the findings. The conclusion chapter will provide a summary of the findings and then provide recommendations on how organisations can make use

of big data analytics to improve the efficiency of their operations. Additionally it will also provide limitations of the study and recommendations for further studies.

CHAPTER TWO: LITERATURE REVIEW

2.1 General Overview of Big Data Analytics

The continuous generation of data presents organisations with enormous opportunities for improving their products if they can effectively utilise big data analytics. According to Mayer-Schönberger & Cukier (2013), organisations often get data exponentially. The data comes from multiple sources like payment systems all of which should be effectively utilised in improving organisational performance. According to Ohlhorst (2013), the way the organisations manage this data will play a big role in the society in future as applications of big data analytics gain acceptance in more fields. Zikopoulos (2012) asserts that big data has so much potential if organisations can use it effectively to improve their performance. There are many different advanced big data analysis techniques that organisations can use in analysing big data. The techniques include text mining, predictive analytics and semantic analysis (Minelli, Chambers & Dhiraj, 2013). Prajapati (2013) asserts that organisations should analyse data at different levels in order to be able to gain a deeper understanding of the data and use it effectively. However, Zikopoulos (2012) warns that the development and use of big data requires a proper understanding of all the issues that come with big data.

Ohlhorst (2013) claims that efficient use of big data requires organisations to integrate, manage and utilise it to create value. It entails using the data and extracting value from it and then using it to improve the performance of the organisation as a whole. Big data has essentially changed the manner in which organisations operate as firms are able to access more information regarding their target market segments (Prajapati, 2013).

Pries & Dunnigan (2015) assert that big data has the potential of improving decisions and competitiveness of organisations if used effectively. For instance it can help organisations to pay more attention to the demands of the customers and manufacture products that meet their needs. Big data analytics are important tools that enable organisations to analyse data that relate to their customers and their target market segment. Big data analytics enables organisations to understand market trends, preferences of the customers and their behaviour. Organisations can use the data to make informed decisions regarding their products and operations in order to meet the needs of the consumers (Zikopoulos, 2012). There are different analytic tools for analysing big data and any tool that is chosen for analysing big data should be mindful of the characteristics of the big data being analysed. Hadoop is the most common platform for analysing big data as it is an open source. It has the potential of analysing large amounts of data and can serve as both organiser and analytics tool. The framework makes it easy to process large amounts of data with different structures. However its main disadvantage is that it is complex to configure and administer (Mayer-Schönberger & Cukier, 2013). The other common data framework is Spark and it has overtaken Hadoop in terms of being active. The two frameworks are not comparable directly although they have many similar features. These two frameworks are both open sourced and provide the most popular tools for analysing big data (Pries & Dunnigan 2015). Hadoop was the leading open source framework but it has now been overtaken by Spark which is more advanced. Ohlhorst (2013) notes that these two frameworks do not exactly perform the same tasks and as such are not mutually exclusive as they can work together. Spark is faster than Hadoop in performing certain functions although it does not have its own distributed storage system. Prajapati (2013) argues that distributed storage system is important for big data as it enables data sets to be stored in multiple computers.

2.2 Big Data and Organisational Performance

Information technology forms an integral part of modern firms and is significantly changing many business processes. However, practitioners and researchers are still struggling to explain how information technology contributes to organisational performance (Minelli, Chambers & Dhiraj, 2013). Despite the fact that there is significant research on big data analytics, many researchers still remain unsure about the ways that big data can improve organisational performance. The need to understand the interests of the consumers has increased tremendously with the continued rise of online shopping. Simon (2013) asserts that the World Wide Web has been offering unique data collection methods since the early 2000s. The web shops are able to track what the consumers are buying, how they navigate through the shops, what else they looked at, how the page layout influenced their decisions and if they clicked on promotion link. These shops are also capable of conducting A/B testing. Minelli, Chambers & Dhiraj (2013) assert that this test compares different metrics of the customer behaviour to find out which one is performing better between A and B. The organisations that make efficient use of the web have the ability of creating value from such data and create competitive advantage over the others that are still reliant on conventional methods. Simon (2013) argues that the organisations that are still reliant on the conventional methods do not have access to this type of data and as such they do not even have the ability to derive value from it since they have no access.

According to Zikopoulos (2012) the modern organisations not only want to know what is happening but also the reasons behind such activities in order to be able to predict future events. Owing to the fact that more organisations are appreciating the need for such insights, data generation, collection and analysis has exponentially increased. According to Ohlhorst (2013) the modern organisations and their employees perceive big data as an opportunity that they can

use for targeted marketing, optimising offers and making comparisons. Mayer-Schönberger and Cukier (2013) claim that the ability of an organisation to make timely analytics on big data is a significant factor that determines organisational success. This then leads the discussion to big data; what is big data? Several definitions have been put forward in academic literature. For instance Sinha (2014) defines big data as a huge volume of unstructured data that is generated by high performance applications. Pries and Dunnigan (2015) on the other hand define big data as a technological, cultural and scholarly phenomenon that is dependent on the interplay between technology, methodology and analysis. Provost and Fawcett (2013) claim that big data is an indication that the data is extremely big, fast or hard for any existent analytical tool to process. However for the purpose of this study, big data will be defined in terms of the 3V's. These V's stand for Volume, Variety and Velocity; volume means that the amount of data is huge, variety means that the data comes from various sources and velocity refers to the continued growth of unstructured data (Franks, 2014).

Sinha (2014) claims that big data opens up many opportunities for organisations and many researchers and practitioners are recognising it. For instance many organisations are now making strategic decisions based on big data. This is what Provost and Fawcett (2013) refer to as evidence based decision making. Zikopoulos (2012) argues that the more a firm characterises itself as data driven, the more it is likely to improve its performance and consistently meet market demands. Furthermore, Simon (2013) adds that the firms that make efficient use of data analytics are twice likely to perform better than the other firms that do not utilise big data. This implies that big data can revolutionise the way organisations operate to ensure that they are at par with the market demands. This is because big data analytics allow organisations to make strategic decisions based on current occurrences and enable them to predict future trends.

Therefore implementing big data and making strategic decisions based on big data analytics has the potential of significantly improving organisational efficiency. However, Belanger (2013) claims that more data does not always mean that there is better data. This is because there are many theories that explain why consumers behave in a certain way and why they would consume certain goods and services more than the others. Moreover, analysis of big data is of very little value or no value if the decision makers are not able to generate meaning from the big data analysis. In fact Minelli, Chambers & Dhiraj (2013) add that the biggest challenge in big data is not collection and analysis, rather the real barriers arise from the ability of the managers to adopt the recommendations and advocate for cultural change in the organisations. Simon (2013) also warns that big data can also lead to inaccurate correlations i.e. spurious correlations. These correlations can occur if an employee spends time analysing mobile phone data of the consumers and checks the time that they spend with the other people that are important to them. However, if a customer is spending more time with the friends than family, this does not necessarily mean that the friends are more important family.

A firm can either buy or develop big data analytical tool to help it in analysing data and establishing correlations and patterns in consumer behaviour. Belanger (2013) notes that technology is one of the most important factors that can be used in solving the big data puzzle. Most firms use business intelligent tools that enable them to turn unstructured data into valuable insights (Marr, 2015). Such tools enable the firms to store and extract data from different databases. Craig and Ludloff (2011) argue that most firms have access to billions of transactions data, log records and other statistics about the consumers. However, the challenge comes in finding ways of analysing such data within a short period of time and using the information to make timely decisions. Moreover, Prajapati (2013) adds that most open systems that use public

software like Postgres and MySQL are not as efficient compared to the premium systems. Therefore, organisations and business analysts expect big data analytics to be MAD (i.e. magnet, agile and deep) (Marr, 2015). A magnetic system is capable of grabbing all data regardless of their quality and structure. Agility requires that the system be flexible and adaptable. Lastly a deep system is capable of supporting conventional business intelligence and complex statistical analyses. There are various types of MAD systems that organisations can use for analysing big data. For instance Hadoop is one MAD system that is increasingly gaining popularity and can be said to be the next generation system of data management (Craig & Ludloff, 2011). The factors that make the Hadoop system MAD are as follows:

- The system is capable of copying files into the distributed file system i.e. Magnetic
- It uses MapReduce to separate computational tasks i.e. Agile
- It has third party extensions that allow users to make computations in the general programming languages like SQL and Java i.e. Deep.

Therefore the Hadoop system has the potential of helping organisations analyse data and make correlations that can be used to get insights from big data sets.

2.3 Business Intelligence

Loshin (2013) claims that the ability of a firm to make effective use of all available information to improve its operations is a major factor that determines its success; in fact the ability of an organisation to gather data and transform it into effective business information in time is not only essential for success but also for survival. For instance a casino can gather data on special events or slot machine usage to track the preferences of the customers. This information can then be

analysed and used to target more customers. However the challenge to transform such information into strategic business information is increasingly getting difficult for organisations owing to the continued exponential growth of data and the number of employees who need access to it (Rabl et al, 2014). As such, firms need to have applications that will enable the data savvy employees to access, analyse, share and visualise all available data. For instance, they can create applications with visual dashboards that allow the managers to track the critical performance indicators of organisational operations. Such applications are referred to as business intelligence applications and can be used by organisations to create an information centred decision making approach.

Raj et al (2015) notes that business intelligence does not only have the ability of improving the knowledge of a firm but also reduce the costs of information technology by removing unnecessary and duplicated data. This then leads to the question, what is business intelligence? Different scholars have given different definitions of business intelligence. For instance Loshin (2013) defines it as the process of converting unstructured data into meaningful information that organisational employees can derive insights from it and use it to make business decisions. Rabl et al, (2014) on the other hand define it as a process that entails two critical activities. The first is data acquisition and the second is data analysis to get meaningful insights that can be used in informing important decisions. Atzmueller, Oussena & Roth-Berghofer (2016) define business intelligence as a group of technologies that allow organisational employees to make better and faster decisions. However for the purpose of this study, the definition that was provided by Aluya (2014) will be used. Aluya (2014) defines business intelligence as the use of applications, methodologies and techniques to analyse data with the aim of helping organisations develop a better understanding of their operations, target market and make decisions in time.

According to Rabl et al (2014), there are many business intelligence applications now and more firms are appreciating their importance in operations. However, this leads to the essential question about the benefits that these firms derive from using the applications. One of the answers to this question is provided by Atzmueller, Oussena and Roth-Berghofer (2016). According to Atzmueller, Oussena and Roth-Berghofer (2016), business intelligence applications empower firms to be able to identify target markets and build long term business relationships with the customers. Moreover, the business intelligence applications enable organisations to systematically analyse the external business environment. For instance an organisation can run the applications weekly to extract valuable data on market competition and identify new opportunities in the target market. These applications can also be used for collecting and analysing real time data. For instance a call centre can use live screens to study airline performance and identify the passengers that face the risk of missing their flights. However, Franks (2014) cautions that some firms may not fully appreciate the benefits of business intelligence applications because some of the benefits are intangible and are not financial. Most of the applications that analyse big data only provide few different perceptions of information. Moreover Schmarzo (2013) argues that over 50% of business intelligence application costs and 80% of the time spent on them are functions of poor quality data, problems with ownership of data and legacy systems. For instance the applications require specific IT infrastructure for them to be able to function effectively.

2.4 Big Data and Competitive Advantage

The discussion has so far indicated that the information that is contained in big data has the potential of improving organisational performance. Once the data has been extracted and analysed, the insights derived from it can be shared to the decision making organs of an organisation for action. According to Aluya (2014), the new knowledge and technique of

deriving information from big data has the potential of bolstering innovation, growth and productivity in a firm and create economic value. Therefore big data is an important resource that organisations can use in developing competitive advantage. Big data analytics combine various sources of data to extract insights that would have otherwise not been possible to extract using the conventional methods. As such they enable organisations to analyse large volumes of unstructured data within a short period of time (Craig & Ludloff, 2011). In addition to this, big data analytics like Hadoop and wide use of cloud computing has made it possible for organisations to analyse data within a short period of time thereby leading to more value as firms are now able to use real time analytics to rectify mistakes instantly.

Belanger (2013) asserts that big data analytics brings competitive advantage to organisations by making their resources more strategic through making them rare, less imitable and more valuable. The attributes of value, imitability and rarity are factors that organisations can use in creating competitive advantage as they confer more potential to organisational resources. Therefore the firms that have such kind of resources can use big data analytics to improve the efficiency of their operations. This implies that although big data analytics have the potential of improving organisational performance, the organisations that are able to adopt quickly by realigning their resources tend to derive more benefits. Marr (2015) emphasises this by asserting that organisations should always ensure that there exists positive relations between big data analytics and the other organisational resources in order to be able to develop competitive advantage. Lack of enough employees with the knowledge on how to interpret and manage big data analytics can significantly reduce the level of compatibility thereby leading to inefficiency. The inefficiency results from the fact that it is harder to develop routines between departments and resources without the right personnel. This shows that big data analytics alone without the

required resources to implement the recommended decisions may have very little or no benefit to an organisation. Craig and Ludloff, (2011) note that the big data analytics create competitive value by improving the quality of goods and services offered to the consumers. In addition to this, it also enables the organisations to discover and exploit new market opportunities, improve the efficiency of their supply chain, increase sales volumes and their decision making systems. These are all benefits that organisations can derive from the efficient use of big data analytics.

The literature review has shown that big data analytics is a big driver that organisations can use in improving the efficiency of their operations. It has indicated that firms need to have the relevant resources and align them with the big data analytics in order to be able to derive higher benefits from the tool. It is the unique relationship between big data analytics and other resources such as human capital that make organisations more competitive as they are not easy to imitate and bring value to firms.

2.5 Comparison of Big Data Analytic Tools

There are many different big data analytics software that can be used for analysing big data. However it is not easy to determine which tool is appropriate for which purpose. As such there is need to compare and contrast them in order to find the one that best suits the desired purpose. It is always important for an organisation to pick the right analytical tool to ensure that the big data analytics improve organisational performance. When selecting the tool, special attention should be paid to data storage, migration, solution scale and the time required to carry out the process (Craig & Ludloff, 2011). Owing to such variations among the frameworks, it is important to identify the significant differences between them. These tools and framework are analysed in terms of the difficulty and expertise required to use them and their use in big data analytics. The table below provides a comparison of the major big data analytic tools.

Table 1. Comparison of Big Data Analytic Tools

	Cloudera	**Hortonworks**	**HDinsight**	**AmazonEMR**
Product Summary	Hadoop open source and allows for proprietary management	Hadoop open source	Uses azure cloud	Uses Amazon Web Services (AWS) cloud
Migration	Data must be migrated	Data must be migrated	If the data is in Azure then no migration is required	If the data is in AWS cloud then no migration is required
Scalability	Fixed cluster	Fixed cluster	Elastic, manual scaling	Elastic, manual scaling
Data Source	Premises	Premises	Azure	AWS
Deployment	Premises	Premises	Cloud	Cloud
Set up	Manual	Manual	Automatic	Automatic
Processing Engine	Requires installation	Requires installation	Hive, Map Reduce, Storm, Spark, Pig and HBase	Hive, Impala, Map Reduce, Storm, Spark, Presto, Pig and HBase

Loshin (2013) asserts that predictive analytic tools should focus on efficiently analysing big data sets. The big data analytics significantly impact operations in different industries as the policy makers use the results of the analysis to formulate and implement critical decisions. As such the big data analytics should be able to assist firms in extracting high quality information from the big data. An organisation should be able to select the right analytical tool based on maintenance, implementation, customer support, user experience and training. The next section presents the strengths and weaknesses of Microsoft, Amazon and Cloudera.

The Amazon Web Services carries all the big data analytics in the cloud as indicated in the table. Amazon Web Services provides the third party firms like SAP, Cloudera and Microspft with management services for big data analytics. It provides web hosting in addition to the analysis which makes it unparalleled in terms of uptime and economies of scale. It offers the users a basic framework but offers very limited customer support. This means that the Amazon Web Services is the ideal tool for users that know what they are doing and its cost is also reasonable. It supports tools like Spark, Hadoop, Hive and Pig which enables the users to develop their own solutions and create personal big data stack. Moreover, Amazon Web Services offers the users tutorials, guides and video demos to help them in data analytics (Rabl et al, 2014).

Cloudera on the other hand is the main distributor of Hadoop software package. The Cloudera framework extents the data processing tool into a hub for managing data. Cloudera search and Cloudera Impala are efficient in scaling, controlling and auditing. Microsoft runs on Hadoop and can be used on windows and in cloud. Hadoop gives the business users the ability to get insight into big data using tools like Office 365 and Excel. Microsoft can be integrated into the other databases to enable the analysis of both unstructured and structured data and the creation of 3D visualisations. It incorporates Polybase to allow the users to combine both non-relational and

relational data using the same techniques for SQL Server. Microsoft solution allows the users to analyse Hadoop data using Excel which is a major advantage of using it given that Excel is a familiar software to many users.

2.6. Advantages and Disadvantages of the Tools

The Amazon Web Services is a cloud giant and is the most appropriate for firms that want to run data on its cloud. It enables the users to connect with the other enterprise data centres. The weakness of the Amazon Web Services is that it does not support software and hardware systems. In addition to this, it does not provide in in memory but allows the users to use third party options like ScaleOut, Cloudera, Hadoop, MapR and Altibase. Cloudera offers support for the Hadoop open source to improve performance, security, reliability and control access (Provost & Fawcett, 2013). Its disadvantage lies in the fact that it does not have its own software and hardware systems. However, it partners with the other third party providers like IBM, Cisco and Dell. The main advantage of the Microsoft framework is that it combines structured data from the parallel data warehouse and Hadoop unstructured data into common tools like Excel for analysis and visualisation. The weakness of the Microsoft framework is that there are very few parallel data warehouse deployments. Furthermore, it does not provide the users with the necessary software and hardware systems but instead relies on partnerships with HP and Dell data warehouses (Pries & Dunnigan, 2015). This review has revealed that the big data analysis platforms and software tools are not capable of providing full services in all the areas. Instead, they are reliant on third party appliances and partnerships in order to be able to cover all the categories. Users should select the frameworks based on purpose. The Amazon Web Services is ideal for those who have the technical knowledge and want to cut down on costs as it only offers basic framework without user support. Microsoft is the most appropriate for Hadoop users because of its cost and it can both windows and cloud. Cloudera is the most appropriate for the

users that are heavily reliant on the Hadoop open source system because of its reliability, security and data access. This section has identified the frameworks that are already available, their advantages and limitations. It has covered various studies on big data analytics and the findings show that it has the potential of improving organisational efficiency. However, there is still a dearth in research on how organisations can use big data analytics to optimise their products to ensure that they consistently meet the demands of the consumers. The current study aims at filling that gap by showing how organisations can use big data analytics tools to optimise their products. The next chapter highlights the methodological approach that will be used by the researcher to attain the aim and objectives of the study.

CHAPTER THREE: METHODOLOGY

3.1 Tableau Software

The application is simple and easy to use with enhanced data visualization features. It offers a framework for companies to employ analytic culture. Tableau is an analytical tool that operates on the principles of big data technology. The technology was developed by experienced data scientists most of whom work for Fortune 500 companies. High performing firms use Tableau for their business intelligence (H. Chen, Chiang, & Storey, 2012). It has a wide range of uses. Its applications depends on the approach used and business owners willingness to make decisions based on its results (Leavitt, 2013; Morton, Balazinska, Grossman, Kosara, & Mackinlay, 2014; Murphy, 2013). The majority of multinational companies recommend the application as the best for conceptualizing data.

3.2 Visual Analysis

Tableau Drive is all about helping businesses have a visual analysis (VA) of collected data. VA combines iterative data acquisition, analysis, and relevance to the research question. Cycle of Visual Analysis (CVA), is the Tableau version of this process and can be summarized as shown in Figure 1

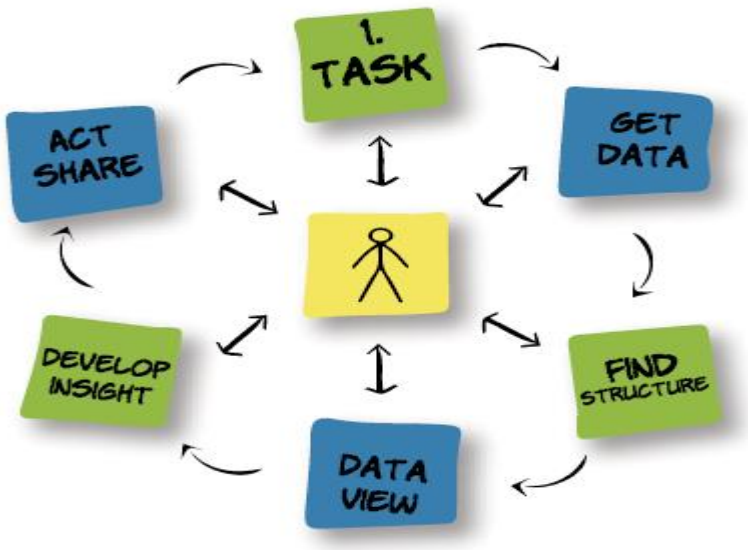


Figure 1. Cycle of Visual Analysis

The CVA operates on Agile technology. It works hand in hand with agile technology by allowing for a distribution of functions between various departments in an organization. It gives full control to Business users by allowing them to make wise decisions based on presented information.

Technological revolution has changed the way data is being analyzed. Visualization makes data more powerful and therefore increasing its applications in the field of business intelligence. Tableau offers a way for business organizations to visualize regardless of backgrounds and industries. Most firms worldwide acknowledge that the ability to effectively view data helps in creating better understanding and in making wise business decisions. The software helps companies to keep pace with the changing technology giving them a competitive advantage over their competitors through an adaptive and smart way of envisioning their data.

The software was developed for processing and analyzing information in a systematic, easy to follow way. This reduces development period, making business data elegant and attractive. The capacity to cope with market faster is a valuable competitive benefit. Tableau allows businesses to make fast business choices based on the envisioned data giving a business an advantage over their rivals.

Data analytics is not supposed to be hard, however several data visualization tools make it look complex. Tableau gets rid of all complications, focusing on what is more important which is finding value in an organization's data. The application's drag and drop feature is easy to use, therefore one doesn't need to be a data guru to run it.

Praised for its powerful Big Data capacities, the software makes processing enormous amounts of data easy and effortless. It can assess and conceptualize data far better than other data visualization software available on the market, regardless of how large a data is.

With Tableau all data are created equal. The interactive feature is bolstered by a super-fast data processor that can crunch data from multiple sources with unparalleled intuition. One no longer needs to worry about which data conceptualization software to work with based on business data, since the software does it all. The company has won several awards in the field of business intelligence and is rapidly becoming the benchmark for quality in data conceptualization.

3.3 Achieving Maximum Output from Tableau

According to Tableau (2015) the most efficient and effective way to use the application is by performing real-time analysis within the context of multi-functional teams. This approach is referred as Drive Sprint. On any Drive Team that a business uses, it will require people to fill multiple roles, so us to make the best decision. To optimize product and processes involved in their production, it is recommended that a Drive Group should comprise of the following group;

Project donor: The individual who gives instructions for project work to commence. He/she/they will likely be a senior manager whose function will be impacted by project results. He should be proactive from project inception, working together with the Project Manager. After the task has kicked off, there has to be a systematic review of the work. The Sponsor should offer the strategic lead in the project, aligning it with corporate vision and mission.

Project Manager (PM): The PM should liaise with the Executive Sponsor, in enforcing project. He/she should ensure that the project meets the deadline and complies with the given estimates. He needs to ensure the assignment has enough staffs. He should manage working relations with a multidisciplinary team, ensuring resources have been efficiently allocated and utilized in an efficient manner.

Tableau Champion: The person should have a vision on how the application can help the business to achieve their goals utilizing analytics. He/she ought to be very conversant with the problems the analytics are designed to solve explaining the importance data analysis and interpretation. The individual is involved from start of the task to its termination. The champion could do a prototype analysis and use the data to direct the larger project.

Tableau Administrator: The individual should be responsible for the project installation, and configuration. He ought to make publications and handle the data sources so that it is aligned with governance policy of the entire company.

Tableau Author: He/she will design and staging dashboards to data extraction environment. He should have extensive experience with the software so that he can build and schedule for data visualization.

Tableau Consumer: This is the person that is responsible for using the application to carry out all sorts of the data analysis. He should be able to answer any question regarding data collection procedures, extraction analysis, and interpretation.

Database Manager (DBA): This ought to be an IT person responsible for upgrading monitoring and maintenance, of the organization's databases. The Drive team can call on the person for connection or troubleshooting problems related to data analysis. The person should be able to model the data store to allow for optimized incorporation to big data analytics.

Data Keeper: He has a responsibility of maintaining data in the data base. Even though this would be a broad job, its role should incorporate protocols, regulations and administer the company's whole data by firm's regulations. It is required that keeper understands the way a company operates with data interactions. The keeper should, therefore, document protocols for data access. He could work with database manager to plan and execute data governance and compliance regulations

3.4 Product Process Optimization

This study intended to embed itself on Tableau Analytics to investigate whether the technology would help in enhancing product, process control, and ultimately improving customers' experience. The approach used was to align product, process, customers and platform to drive an embracement and implementation of a controlled, analytics culture in organizations. The reusable and scalable framework that could be reproduced across departments was created. Vibrant governance practices were implemented to come up with a secure way to share data with other users, as well keeping the cost manageable throughout the utilization of this method.

In an effort to evaluate how Big data could be used to enhance products and processes, relevant literature was used to better understand how Tableau Analytic Tool works. Key search

words used were; Big data, Business Intelligence, Web analytics, Product optimization and process optimization. To discern big data usage trends in UK companies, historical performances of various companies were studied. The period studied was from 2004 to 2015. Relevant articles were identified from several reputable online libraries. To guarantee consistency and pertinence across data collection, it was ensured that all the major sectors in UK businesses were covered. This study aimed to establish the use of Tableau analytics as the method of choice for promoting Big Data within organizations. For this, a four-phased Tableau Drive approach was used for data collection and analysis. Tableau offers an advanced level of data support including restrictions based on field values, SQL data and merged queries on several tables. The output was filtered to limit the fields that were relevant for the study.

3.5 Phase 1: Discovery

A discovery inquest was carried out to determine about UK companies' that used Business analytics in their operations. This was done so as to validate promotion of analytic culture within the modern business. A total of 33 companies were used in the research. Each of the companies was contacted and notified of the nature and intention of this study. Some accepted to have their business intelligent data shared while others did not. However, the research only worked with the firms that agreed to cooperate. In addition to accessing business intelligence data, extensive interviews were conducted with the relevant senior managers to confirm businesses' history and current state, historical strategies, and frequency of use of analytics software, and hardware environment.

3.6 Phase 2: Prototyping

After the discovery stage, one week was dedicated to learning how to use Tableau Analytic tool so as to smoothen data collection, analysis, and interpretation process. Businesses

that had used business analytic tools for a while were included in the study as well as those who had not, even though they showed passion for embracing the culture. Priority was given to Tableau users that were technically open to sharing the business data. Within the study group, some organizations stood out as ideal candidates for the research study while other seemed average candidates. The data in this study was purely based on reports the business had accepted to share. The majority of the company's had their data stored inform of an Excel spreadsheets while a few preferred to keep data inform of customized worksheets. Data analyses for the study were done after all the data had been extracted from Tableau. Tableau provides a self-service, "fast data engine search" tool with a simple file extraction system. All the data for the 33 companies were simply extracted and summarized. The summarization process involved utilizing data information that was relevant to achieving the research objective while excluding unimportant ones.

3.7 Phase 3: Scaling Out

Two projects or sites were first set on Tableau Server. A *project* is defined here as Tableau collection of worksheets that are related, while a *site* is to the entry point to data collection. For different companies or organizations single server, separate servers were used. One will be the A sandbox environment was likely established in the process. The other kind of environment used was a certified production structure. Business reports were all stored one the sandbox and a certified environment. The research opted to use the simplest and an easy to use data framework. The issue of adding complexity was avoided at all costs. Errors in data analysis that occur as a result of leveraging several complexes were avoided and instead one semantic layer was utilized. For all the companies studied, extracts were hosted by the Tableau since they have a wide range of data analytics storage base. A major advantage of using extracts is that they don't require any indexing.

Parameters relevant in addressing the research questions were not only studied but also the relationships between them were investigated. The variables studied include the period a business had been using analytic data for its product and process optimization, the revenue generated as a result of using or not using the tool, the growth rate of business due to embracing the analytic culture, number of workers, and customer intimacy score. The companies studied varied in their line of business ranging from healthcare and energy to product and consumer services. Presentation of the results was done in diagrams and graphical forms starting with companies that had embraced big data analytic culture for the longest period to those that had never used the tool in their business units.

CHAPTER FOUR: RESULTS

The collected data are as follows: Figure 2 represents the ranks of companies according to the periods spend in using big data analytics. British gas, Savills Estate Agents and Vinci Construction UK had been actively using the analytic application for the longest period (11 years), while the bottom five companies had never had an experience with the technology. AstraZeneca and GlaxoSmithKline are both pharmaceutical companies. GlaxoSmithKline had been using big data for 10 years while AstraZeneca had used it for 9 years. E.ON and npower had used it for 9 years. April UK, British Business Bank, Sapience HR, SW Group Logistics had a similar ranking. DENSO Manufacturing UK and Fleishman Hillard had a similar ranking. Boston Consulting Group, Software Companies, The Green Insurance and Vodafone had similar years of experience with analytics technology (6 years). Hunter Adams, John Lewis KCOM Group, Keytech and Protiviti had never had any experience with analytics concept.

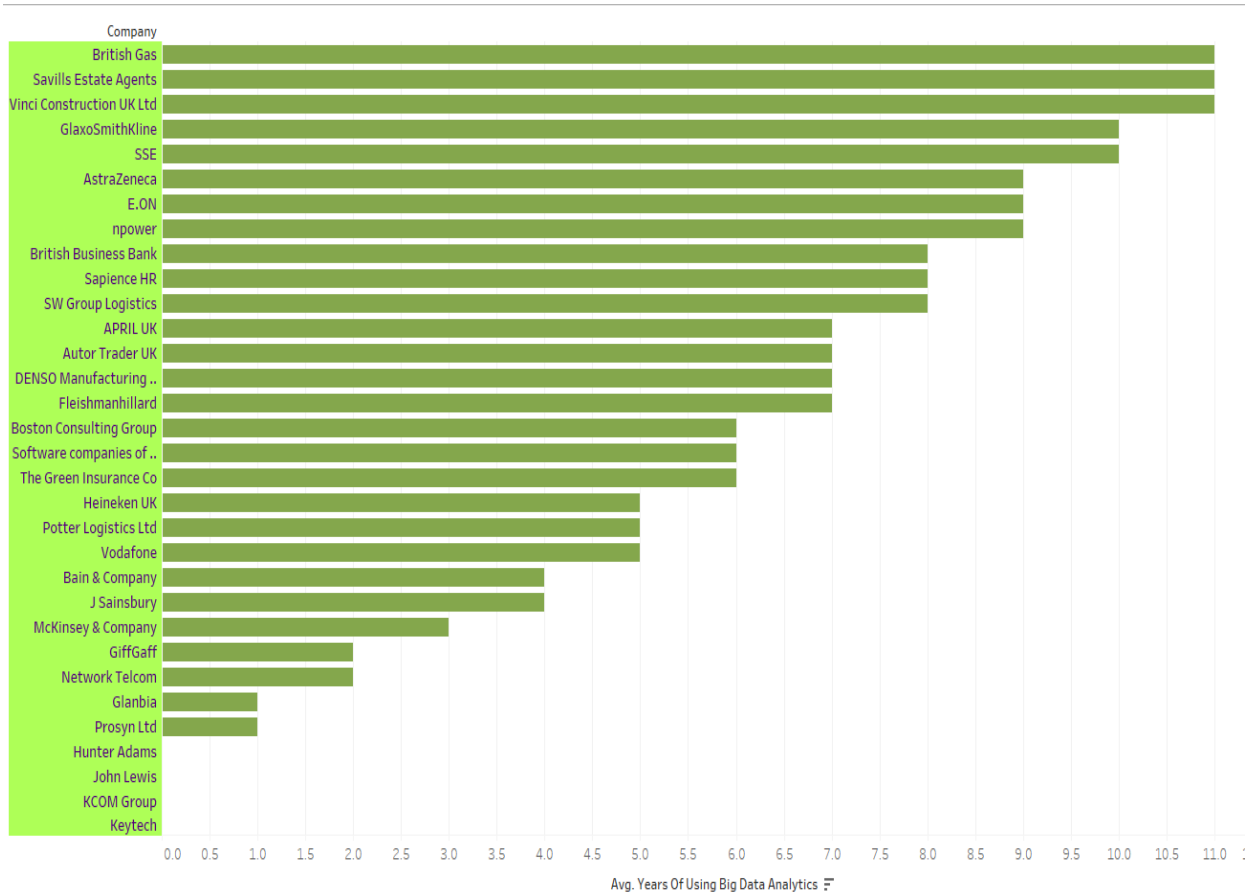


Figure 2. Periods that companies have been used data analytics from (2004- 2015)

Figure 3 is a representation of data about the growth trends of companies with the number of years the business has been using the technology. One can tell that there exists a proportional relationship between years spend on analytics data and business growth. For instance, British Gas reported the highest growth rate while Heineken UK had the least growth. According to Figure 3, the same company has been found to have used the software for the longest time while Heineken UK had never used the application before. SSE was the second firms with reported growth of 400%.The values are significantly different from British gas. This is still a significant growth by any standard given that the firm had invested significant a significant amount of time in technology. Savills Estate Agents had a growth of 340%.

According to figure 3, the company had utilized analytics technology for 11 years just like the British gas. Vinci Construction UK Ltd reported a growth of 327% having invested a significant amount of years in analytics data. The bottom four least performers were Heineken UK, Potter Logistics, Boston Consulting Group and Vodafone. As can be seen from the graph, growth rate increases with period invested in the technology. This means that utilization of Big Data Analytics has a positive impact on business growth.

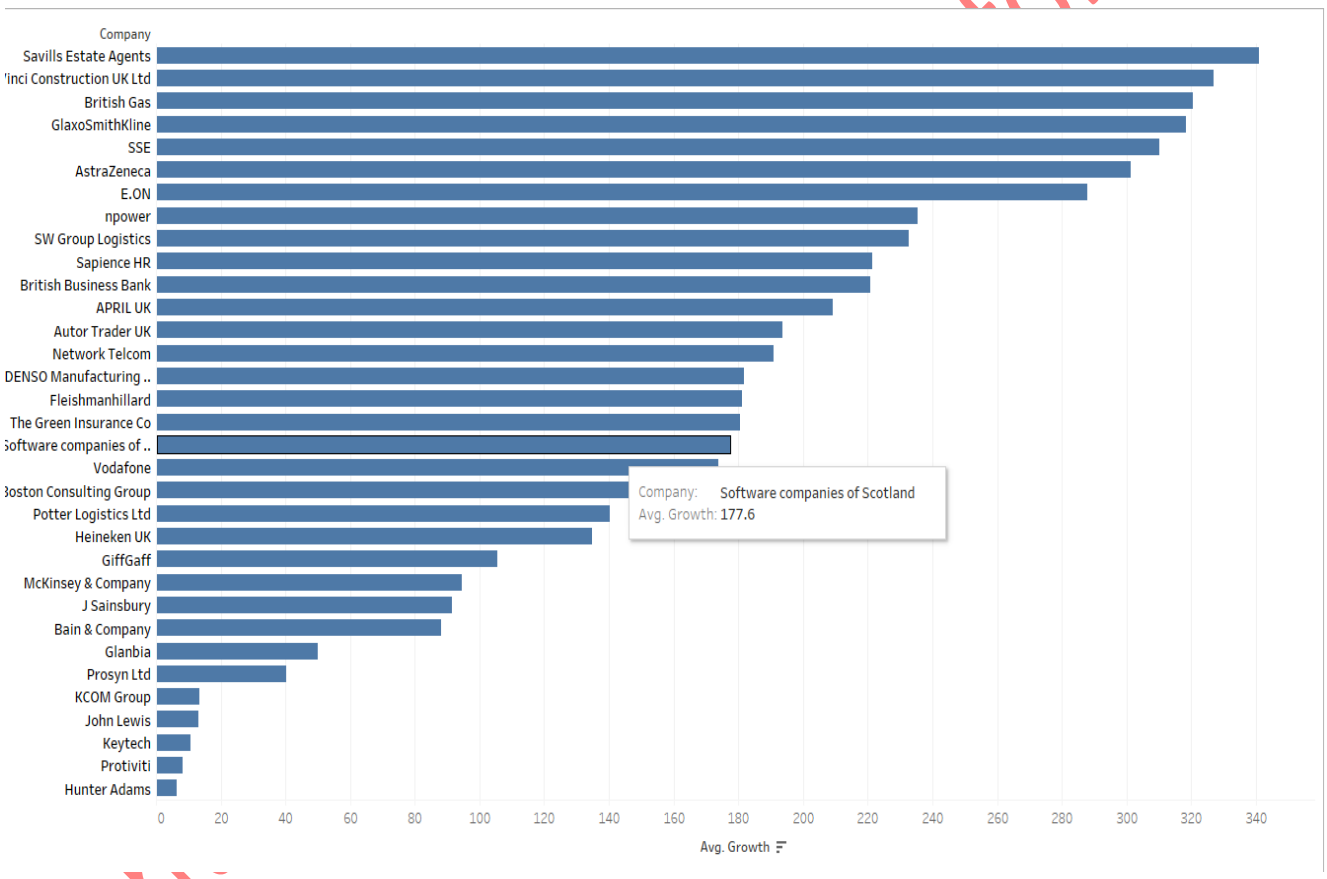


Fig 3 Average growth of companies between 2004 and 2015

Figure 4, shows the relationship between the period of analytic data interaction with business growth, revenue, customer intimacy and some workers. As can be seen in the data, it is clear that all the three variables (business growth, revenue, and customer intimacy) are directly

proportional to company's period of interaction with cloud technology. There was no significant correlation between some workers in the company and any of the three variables which imply that contribution of a number of workers to business optimization is almost negligible.

British gas scored the highest scored the highest on all the variables tested except a number of workers confirming the undisputed role of business analytics in product and process enhancement. Keytech had the highest number of workers even though the company had almost no experience with analytics concept. Savills Estate and Vinci Construction had been using analytics data technology for the same amount of time11 years. However, the variables tested where different for each of

them.

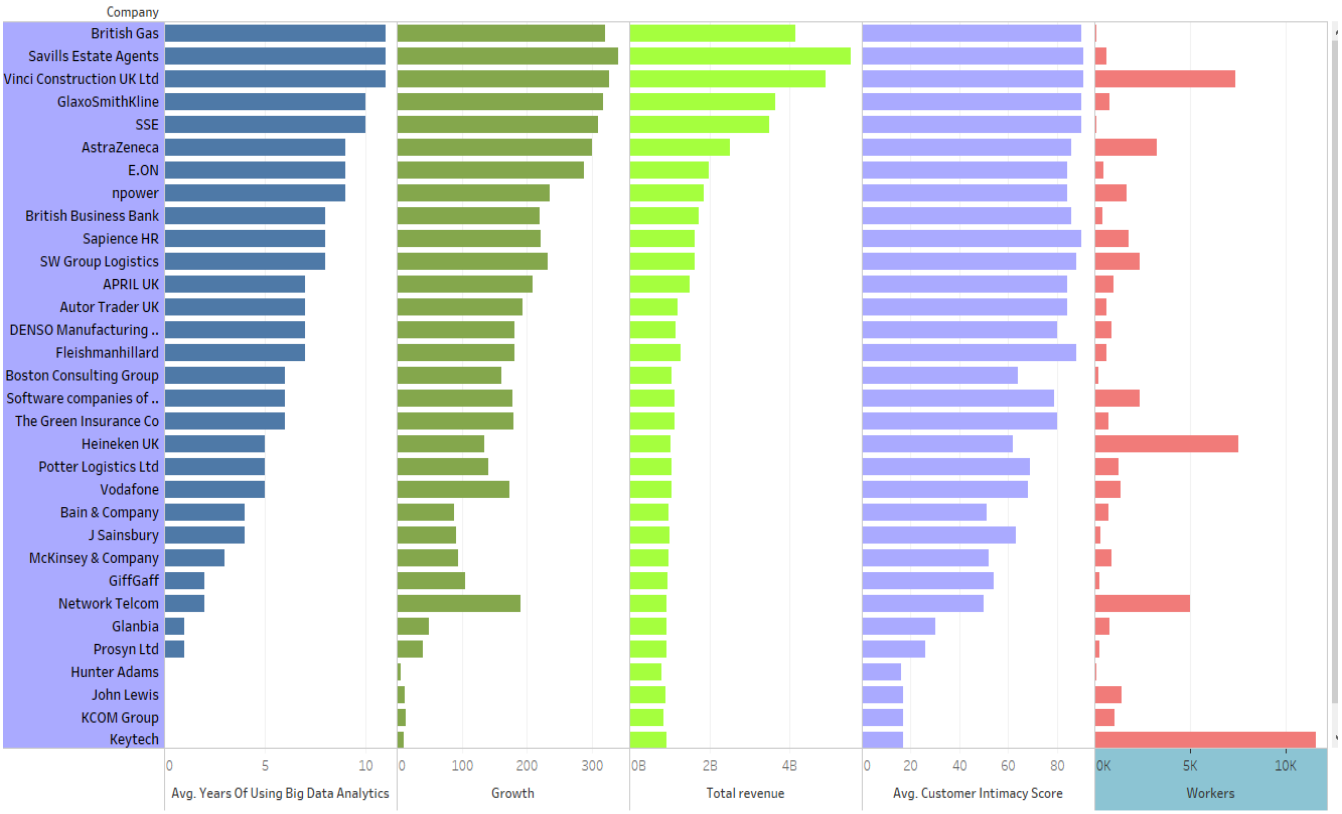
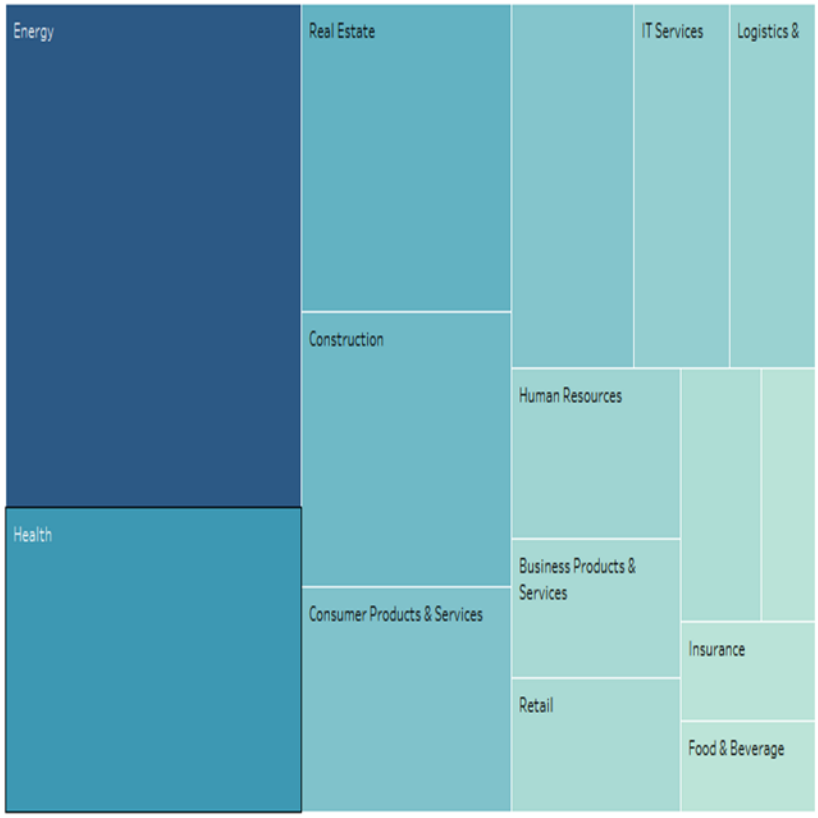


Fig 4 Relationship between use of Big Data and Growth, Revenue, Consumer Intimacy and Workers



Industry	
Energy	12,684,947,616
Health	7,671,725,546
Real Estate	5,528,202,691
Construction	4,911,166,514
Consumer Products & Ser..	4,045,678,867
Telecommunications	3,797,901,127
IT Services	2,969,487,715
Logistics & Transportation	2,668,165,577
Human Resources	2,450,011,000
Business Products & Servi..	2,025,191,617
Retail	1,929,510,345
Government Services	1,724,988,401
Manufacturing	1,166,718,000
Insurance	1,138,554,666
Food & Beverage	1,041,888,929

Fig 5. Diagrammatic representation of companies by sector with revenue earned

Figure 5 shows a diagrammatic representation of the business sectors with revenue generated. It can be seen that there is a positive effect on the use of this analytics to the revenue made. The energy sector remains by far (almost double the Health sector) the biggest gainer of the revenue share. IT services and logistics seem to have no such a big difference in their share while sectors like Insurance and Food and Beverage take the smallest shares.

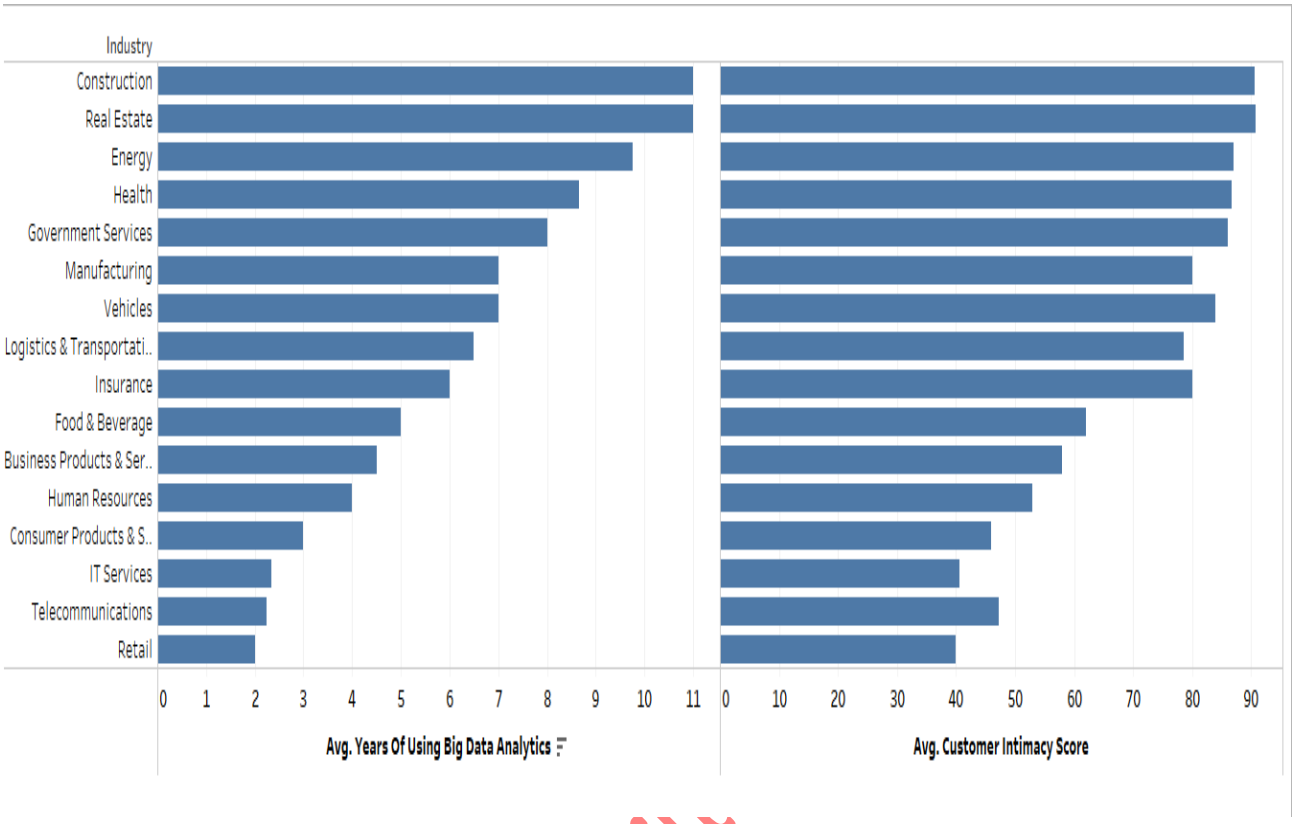


Figure 6: Relationship between years companies spend in Big Data and Customer intimacy

The construction sector is by far the outstanding user of the analytic technology (11 years) with the retail trailing in use (2 years) as depicted in Figure 6. Customer intimacy score shows a corresponding relationship with the time of the technology use i.e. the sector for the longest time has much higher intimacy with the customers. This, of course, is with the exception of Consumer products and services, Telecommunications, Human resource, IT services and Retail sectors. Health sector had the second largest about customer intimacy score. There was no significant difference between IT sector an insurance sector with regards to the variable.

CHAPTER FIVE: DISCUSSION

From the trends observed (on the periods in which the companies have been using data analytics), there is no doubt that Big Data technology is changing the way data is being analyzed. Companies such as British Gas, Savills Estate Agents and AstraZeneca's long history with analytics data could be the reason for the massive amount of revenue generated overtime. The ease with which these firms adapt to new technologies is remarkable. These findings correspond to what (H. Chen et al., 2012; Kambatla, Kollias, Kumar, & Grama, 2014; Russom, 2011) found. In their studies, the authors reported improved revenues for social network sites and search engines, as a result of tapping into Big Data. The collection of marketing information for assessment of the current and future trends will depend on organization's willingness to comply with technological innovations.

In 2013, British Gas prioritized big data at the top of its budget list citing analytics culture as the key for the company's optimized revenues (M. Chen, Mao, & Liu, 2014; Sagiroglu & Sinanc, 2013; Schultz, 2013). The technology was said to have helped in boosting business operations by 59 %. This explains the reason for the highest amount of revenue collected by the company. The firm has a top-notch team of big data specialists who always carry research on how to optimize product and processes, using highly sophisticated software. According to Perrons & Jensen (2015) taking full advantage of the technology, and transforming it into customer satisfaction and revenue optimization, continues to be a huge focus for the British Gas. From the results, one sector that has the potential for revolutionized product and business processes through the utilization of data insights is the energy sector. As a matter of fact, big data

analytics can help businesses and their clients understand how they are utilizing energy, the amount of money they're spending on its ways of making it more efficient.

Both Savills Estate Agents and Vinci Construction are UK property companies. The high amounts of sales turnover by these firms can be explained by the amount of time they have devoted to using big data. This also explains the reasons for the optimized customer intimacy scores and business growth rate.

According to Kitchin (2014), commercial real estate firms not only embrace big data as a means to optimize revenues but also, as a way of reducing financial risk. By evaluating several information sets such as premise age and structure, data on any recent property upgrade, and owner's financial status, it's possible to have a grasp of the market as a whole. This makes it possible to make accurate recommendations to customers. The employment of big data also comes with big advantages for the construction companies (Analysis & Data, 2012; Barlow, 2013; Beyer & Laney, 2012; Bifet, 2013; Du, Li, & Zhang, 2014; Fox & Do, 2013; Hu, Wen, Chua, & Li, 2014; Labrinidis & Jagadish, 2012; J.-G. Lee & Kang, 2015; McAfee & Brynjolfsson, 2012b). By tapping into big data, firms can offer clients a more accurate view of viable mortgage plans and approval probabilities for customers, assisting potential buyers to align their wish lists and budget plans before purchasing a property. This reduces the time wasted by agents searching and marketing properties that cannot be afforded by clients.

According to the presented results, one can say that utilizing a data-driven approach and gathering real-time data about the locale, common selling price, and historical changes in prices, real estate, and construction firms can improve their product and service processes by providing reliable and accurate recommendation which is crucial to boosting both seller and confidence.

GlaxoSmithKline and AstraZeneca the largest pharmaceutical companies in the UK, both of which have been using analytic applications for 10 and 9 years respectively. Their subsequent sales turnover, growth rate customer intimacy score and revenue generated confirms the value of investing in big data. By applying data analytic strategies to make inform decisions, pharmaceutical industries could generate up to $200 billion in value every year by taking advantage of innovation, promoting the culture of research and development. Predictive modeling of product and process control in drug making business becomes significantly complex and widespread. By taking advantage of the diversity of available research and development information, predictive modeling will help determine new highly effective drugs that could act on targets in a safe and effective way.

Studies done by Demchenko, De Laat, & Membrey (2014) reported that pharmaceutical firms have that apply data technology in business operations are 3 times like to experience increased sales turnover than companies that don't. Maintaining consistent and reliable data has been considered one of the biggest setbacks in pharmaceutical businesses. The capacity to integrate data gathered at all phases of the value chain, from drug discovery to clinical applications is a crucial requirement to enable firms to achieve maximum returns from technological trends(Demchenko et al., 2014; McAfee & Brynjolfsson, 2012a; McKinsey & Company, 2011; Munos, 2009; Seebode et al., 2013). Big Data constitute the platform on which value addition of analytics is developed. An efficient data integration allows for authenticity in analysis and interpretation of results. Besides it accurately connects discrete data irrespective of the source (Berman, 2013; Groves, Kayyali, Knott, & Kuiken, 2013). Data integration also facilitates sophisticated searches for data sets based on the connections developed instead of the information itself. For instance, algorithms connecting pharmaceutical R& D and clinical data

could create automatic data that can pin point related applications.

Having an end-to-end integration of information calls for some functionalities including reliable document and data, the capacity to establish connections between diverse aspects, vibrant quality assurance, management of operations, to ensure that crucial information elements are accessible only to those authorized to use it. Most pharmaceutical firms shy off from extensively examining their information gathering system at once as a result of logistical concerns and implied costs.

Five companies had never used Big data in their businesses; Keytech, John Lewis, KCOM, Protiviti and Hunter Adams. It is not a surprise that the firms had least revenue and growth than the other organizations. Even though they had a high number of workers compared to businesses that had robust performances, the missing element of data technology could be responsible for these firms stunted growth. The reason the above organizations have hesitated utilizing data technology could be that they feel a shortage in the data talent(J.-G. Lee & Kang, 2015). Also, to successfully actualize a big data project, there has to be a sophisticated team of IT experts and data scientists endowed with extensive knowledge on how to predict business trends.

Business managers must initiate a shift in institutional culture to make radical leaps towards embracing big data. Most companies like Hunter Adams and KCOM are of the opinion that big data drive should delegate to the IT team only. The analytics culture is treated as a technical threat rather than corporate opportunities (O'Leary, 2013). If Big Data is left to only IT experts, such initiatives may lack sufficient expertise leading to an inadequate understanding of organizations' needs. For instance, Keytech has the largest number of employees out of all the 33 companies studied. One would expect it to be leading on business growth and revenue generation

(Fan, Han, & Liu, 2014; Katal, Wazid, & Goudar, 2013; Labrinidis & Jagadish, 2012). However this, not the case. In such big firms, decision-making often left in mid- leadership level, this may not have adequate knowledge of how to take advantage of rapidly changing technological revolution to optimize business processes.

According to Madden (2012), Big data will be key in driving business revolution endowing firms with deep insights into client's taste and preferences thus enhancing customer intimacy and sales opportunities. However, for many organizations such as KCOM, Protiviti and Hunter Adams, the advantages of big data have not yet appealed to them hence their hesitation in leveraging its potential. A recent study by Economist (2015) reported that that 46 percent of CEO's believe big data analytics is a crucial element, while 30 percent of the managers believe that big data will contribute a big deal in product and process optimization.

However, a limited knowledge on the side of executives on how to leverage on big data could be a mage hindrance in its implementation as can be seen with the bottom five companies. According to Zwitter (2014), only 31 percent of executives admit that analytic data implementation has been a success.

Furthermore, studies have shown that over two-thirds of firms don't have a reliable way of quantifying the success of data analytics. Business leaders continue to spend resources on these initiatives. Almost three out of five CEO's in a recent survey (Kambatla et al., 2014) say their businesses have either invested or plan to spend on big data technology in future. Big data offers a major source of competitive benefits, robust growth, and optimized process and financial growth. However, tapping into big data often calls for changing traditional business models. This kind of radical shift can happen only if leaders direct corporate goals, focusing business resources, holding employees accountable for growth, and celebrating corporate success. To

successfully reap the benefits of data analytics, executives have to focus resources so as to optimize processes, and establish new ways of running companies. Wu, Zhu, Wu, & Ding, (2014) suggest that the bridging the gap between data strategy and implementation should be a long-term goal for companies new to the technology. From the presented results, implementation of big helps in enhancing decision-making processes.

According to figure 4, one can conclude that leveraging data analytics significantly impacts, business growth, financial performance, and customer satisfactions. This is always the goal of any organization. Top performing firms like Savills Estate Agents, British Gas and Vinci Construction know how faster to new ideas on data insight. For instance, British Gas utilizes information from its millions its clients to enhance customer experience. The firm's analytics team is involved in every data hence driving decisions across the entire business. The effect of leveraging customer analytics to forecast demand has been the reason behind the exponential growth in the top 5 businesses studied in this project.

The most performing companies studied here have established a culture where people understand data makes a business proposition stronger and improved financial performance. These firms have a sophisticated team of data scientists that ensure information flow across business units is efficient so as to facilitate superior decision-making. Savills Estate Agents customized house designs, for example, is as a result of client insight, superior architecture, and marketing. The connective thread is data-driven decisions throughout an entire process.

To change traditional business models, it is crucial to adopt new ways of quantifying performance that can measure an organization's progress or its lack thereof. Executives should consistently review the effect of data analytics on the organization's key performance metrics. One of the way's E.ON and n-power uses to enhance customer satisfaction by use of social and

mobile media to create channels for receiving feedback from clients, and stakeholders. This justifies the reason for optimized customer intimacy scores for both companies. This finding agrees Madden (2012). In his study, he reported that coupling social media technology with data analytics exponentially increased customer satisfaction while optimizing business performance. The of an organization's efforts to identify what's hindering data analytics adaption would help in addressing some of the problems associated with the model.

Even though telecom companies such Vodafone haven't fully explored the world of data analytics, the company's CEO Nick Jeffery said that business had started conceptualizing data as a tool that could boot the business's operations and processes (Hill, 2014). Other companies that have shown passion in leveraging Big data include British Business Bank, Sapience HR, APRIL UK, Potters Logistics, and Network Telkom. Most of these firms have begun taking steps into adapting Big Data in their operations from fixes for urgent problems to long-term corporate decisions. For instance, integrating analytics into British Business Bank's culture led to change that radically increased sales for three consecutive years.

Whereas big data analytics like Tableau can handle exaggerated celebration of mobile and social platforms, the overall potential of the technology has not been fully harnessed. The main concern about big data lies in the latency for obtaining more value faster from complex data, at the lowest price. Big data supersedes a whole range of technologies making business operations efficient and effective.

Some of the top performing companies understand that investments risky and opt to minimize financial by using big data which offers a more practical way of mitigating risks associated with product recalls or sales losses. After analyzing the collected data, it was found out that top 5 best performing companies had a minimum growth of 14% per annum, a finding

that agrees with Jacobs (2009) results. According to the author, high-growth firms were 60% more likely to be utilizing data analytics which has been attributed to organizations growth factor. The studies further reported that 67 % that had experienced a stalled growth were less to embrace Big data technology. The reason why Top performing firms did well than others in this research study are because the high growth firms invest more aggressively on data technology than the other companies. For example, there are chances that listed high-growth companies will more be strategizing on improving upgrading their Big Data portfolios by the end of 2016. AstraZeneca Chief Executive Pascal Soriot (Astrazeneca, 2015) reported that the firm would be planning to invest in technological innovations. For instance, For instance, Tope performing firms are less likely to spend on traditional database system than less performing companies. There is a mounting pressure by firms to incorporate data technology in their businesses, as a time is coming when these organizations will be overwhelmed when it comes to determining how to accomplish their goals in an affordable way with the tradition technology. Also, most of these firms already use social and traditional media to gather information. It is important that firms start with information they can easily decipher then look for ways of integrating them with Big data. Based on Figure 3, companies that grow faster are those that heavily rely on big data that to make key decisions that ultimately impacts growth (McAfee & Brynjolfsson, 2012a). From Fig. Five it can be said that it is not about the just data, it is about coming up with innovative solutions to exceed customer need. To achieve optimal products and processes, firms have to find solutions on how to exploit data technology so as to transcend limitations, reduce expenses, and enhance agility.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter gains the final conclusions of this research work based on the research findings and result discussions. The final conclusions reached at are compared with previous literature works to authenticate their validity. Guided by the conclusions reached at, the chapter makes and presents recommendations for organisations regarding how to enhance the use of big data analytics to assess and improve the performance of their products. Also, the chapter presents the research limitations of this work consequently making recommendations for future research in a similar topic.

6.2 Conclusions

6.1 Research objective 1: To ascertain how organisations can use big data analytics to assess and improve the performance of their products

For the first research objective, this research study has established that big global companies such as Savills Estate Agents, British Gas, and AstraZeneca have a long history with regards to the use of big data analytics to assess and improve the performance of their products. In this respect, these companies use big data analytics to adapt to new technologies, which provide a strong basis for them to assess and enhance the performance of their products. Besides, these companies use big data analytics to collect key marketing information that aids in assessing the performance and competitiveness of their products in the market and consequently plan for the necessary actions to take to enhance future performance. These findings concur with previous literature findings by Chen et al. (2012), Kambatla, Kollias, Kumar & Grama (2014) and Russom

(2011) that tapping into bid data analytics by organisations allows the collection of marketing information for assessment of the current and future trends and this depends on organization's willingness to comply with technological innovations.

Also, the study establishes that organisations such as British Gas use big data analytics to conduct research on how to optimize product and processes. In this case, big data analytics provides the possibilities to use highly sophisticated software that has the highest potential to influence analytical culture in the organisation and consequently help take full advantage of the technology. Through the technology and analytical capabilities, organisations get to key market information that allows the production of customer centric products that ensure greater levels of customer satisfaction. On the same note, it is established that big data analytics help businesses and their clients understand how they are utilizing energy, the amount of money they're spending on its ways of making their businesses more efficient and highly performing. These findings are consistent with previous literatures by Pries & Dunnigan (2015) and Zikopoulos (2012). Pries & Dunnigan (2015) assert that big data has the potential of improving decisions and competitiveness of organisations if used effectively. For instance it can help organisations to pay more attention to the demands of the customers and manufacture products that meet their needs. Big data analytics are important tools that enable organisations to analyse data that relate to their customers and their target market segment. According to Zikopoulos (2012), big data analytics enables organisations to understand market trends, preferences of the customers and their behaviour. Organisations can use the data to make informed decisions regarding their products and operations in order to meet the needs of the consumers.

Further, the study established that organisations such as real estate forms use big data analytics to enhance the performance of their products through reducing the financial risks

associated with their products. In this case, big data analytics is used to evaluate several information sets that concern their products including premise structure and age, data on any recent property upgrade, and owner's financial status. This allows real estate firms to have a grasp of the market as a whole, making it possible to make accurate recommendations to customers, consequently improving the performance of their products. These findings are consistent with previous literatures by Simon (2013) that big data can revolutionise the way organisations operate to ensure that they are at par with the market demands. This is because big data analytics allow organisations to make strategic decisions based on current occurrences and enable them to predict future trends. Also, the study establishes that using big data analytics offers construction companies big advantage of assessing and improving the performance of their products. In particular, by tapping into big data, construction firms can offer clients a more accurate view of viable mortgage plans and approval probabilities for customers, assisting potential buyers to align their wish lists and budget plans before purchasing a property. This reduces the time wasted by agents searching and marketing properties that cannot be afforded by clients. Besides, the use of big data analytics and data-driven approach by constriction firms allows the collection of real-time data about the locale, common selling price, and historical changes in prices, thereby allowing these firms to improve their product and service processes by providing reliable and accurate recommendation which is crucial to boosting both seller and confidence. This is in line with Ohlhorst (2013) postulation that the modern organisations and their employees perceive big data as an opportunity that they can use for targeted marketing, optimising offers and making comparisons.

6.2.2 Research objective 2: To identify the challenges that organisations face in deploying and using big data analytics and how can they overcome them

For the second research objective, this study establishes that maintaining consistent and reliable data is considered one of the biggest setbacks facing organisations especially in pharmaceutical businesses in their effort to deploy and use big data analytics. Having an end-to-end integration of information calls for some functionalities including reliable document and data, the capacity to establish connections between diverse aspects, vibrant quality assurance, management of operations, to ensure that crucial information elements are accessible only to those authorized to use it. However, most pharmaceutical firms fail to maintain consistent and reliable data because they shy off from extensively examining their information gathering system at once as a result of logistical concerns and implied costs. According to Demchenko et al. (2014); McAfee & Brynjolfsson (2012a); McKinsey & Company (2011); Munos (2009); and Seebode et al. (2013) the capacity to integrate data gathered at all phases of the value chain, from drug discovery to clinical applications is a crucial requirement to enable firms to achieve maximum returns from technological trends.

The study also establishes that shortage in the data talent is another challenge organisations face in deploying and using big data analytics. Besides, organisations face the challenge of failure to successfully actualize a big data project because of lack of a sophisticated team of IT experts and data scientists endowed with extensive knowledge on how to predict business trends. These findings confirm the earlier research findings by J.-G, Lee &Kang (2015) that the reason the above organizations have hesitated utilizing data technology could be that they feel a shortage in the data talent.

Further, the study establishes that a limited knowledge on the side of executives on how to leverage on big data is a major hindrance in its implementation. According to Zwitter (2014),

only 31 percent of executives admit that analytic data implementation has been a success. Also, according to Economist (2015), for many organizations such as KCOM, Protiviti and Hunter Adams, the advantages of big data have not yet appealed to them hence their hesitation in leveraging its potential.

6.3.3 Research objective 3: To assess the impact of big data analytics on the ability of an organisation to create value

For the third research objective, this study establishes that the use of big data analytics creates value to organisations through improving their revenue margins, sales turnover, and growth rates. For instance, GlaxoSmithKline and AstraZeneca the largest pharmaceutical companies in the UK, have been using analytic applications for 10 and 9 years respectively and this has subsequently help increase their sales turnover, growth rate and revenue margins generated. By applying data analytic strategies such as predictive modelling, these companies effectively determine new and highly effective drugs that could act on targets in a safe and effective way, thereby improving their sales volumes and revenue margins. According to Simon (2013), the firms that make efficient use of data analytics are twice likely to perform better than the other firms that do not utilise big data.

Also, the research establishes that big data analytics provides the possibilities for an organisation to create value through minimising on financial risk and reducing on time wastage. For example, the employment of big data also comes with big advantages for the construction companies as it provides the possibilities to evaluate several information sets and make accurate recommendations to customers, thus reducing on risks and time wastage. Besides, the research

establishes that utilizing a data-driven approach and gathering real-time data about the locale, common selling price, and historical changes in prices, real estate and construction firms can improve their product and service processes by providing reliable and accurate recommendation which is crucial to boosting both seller and confidence. This finding is consistent with earlier research findings by Demchenko, De Laat, & Membrey (2014) that pharmaceutical firms that apply data technology in business operations are 3 times like to experience increased sales turnover than companies that don't.

Moreover, the study establishes that implementation of big helps in enhancing decision-making processes. For instance, top performing firms like Savills Estate Agents, British Gas and Vinci Construction now faster access to new ideas on data insight, that helps in making better and informed decisions. For example, British Gas utilizes information from its millions its clients to enhance customer experience. The firm's analytics team is involved in every data hence driving decisions across the entire business.

Further, the study found that using big data analytics crates value to organisations by ensuring customer satisfaction. Customer satisfaction is achieved by use of social and mobile media to create channels for receiving feedback from clients, and stakeholders. This justifies the reason for optimized customer intimacy scores for both companies. This finding agrees Madden (2012). In his study, he reported that coupling social media technology with data analytics exponentially increased customer satisfaction while optimizing business performance.

6.3 Recommendations

This study establishes that big data analytics have positive influence in organisational efforts to assess and improve the performance of their products. As such, the research study recommends that organisations continue using bid data analytics for long term benefits including enhancing their performance of their products and ensuring their competitiveness. However, the

research study found that organisations face the challenges of maintaining consistent and reliable data when using big data analytics in assessing and improving the performance of their products. In this regard, this research study recommends that firms adopting big data analytics ensure they have end-to-end information integration, sustain the connections between diverse aspects of the phenomenon, vibrant quality assurance, and effectively manage information elements and ensuring the access of these information elements is only possible to those individuals authorized to use them. This will aid the organisations maintain consistent and reliable data while using big data analytics.

The study also finds out that organisations using big data analytics face the challenges of shortage in data talents and sophisticated team of IT experts and data scientists endowed with extensive knowledge on how to predict business trends. As evidenced in the research findings, this challenge may result in poor assessment and improvement in the performance of organisational products. To this end, this research recommends that organisations adopting big data analytics consider employing more staff to provide the needed personality to manage the big data analytic process. Besides, these organisations can consider undertaking employee training and development with regards to big data analytics in order to equip the employees with important and vital knowledge and expertise on how to use big data analytics to undertake business processes including predicting business trends. Through these mechanisms, the organisations will therefore be able to enhance the effectiveness of their employees in using big data analytics to assess and improve the performance of their products.

6.4 Limitations of this research and future research suggestions

The major limitation of this research study is its wide scope of examining the how big data analytics san be used by organisations to assess and improve the performance of their

products. As such, the findings and results of this study are broad and general in nature. This is because big data analytics has many aspects including big data analytic tools, advantages and disadvantages of big data analytic tools, big data and competitive advantage, and big data and organisational performance. In this respect, further inquiry is required for future research on a similar topic to establish whether these are the only aspects of big data analytics or whether there exists other factors that could have vital effect on the performance of organisational products. Also, it is important that future research consider investigating each of these aspects separately in order to establish and understand their impacts on organisational efforts on assessing and improving the performance of their products. Furthermore, some impact of big data analytics such as sales, business growth, financial performance, and product innovation and quality are overlapping amongst these aspects. As such, future research needs to examine and analyse each of these aspects independently in order to establish and document separate findings on how each of them affect the assessing and improvement of the performance of organisational products.

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