UNIVERSITY OF GHANA BUSINESS SCHOOL

COLLEGE OF HUMANITIES

BIG DATA AND DECISION MAKING AMONG ACCOUNTANTS IN MULTINATIONAL COMPANIES IN GHANA

PRESENTED BY

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DECLARATION

I, Prince Ntiamoah, do hereby declare that this research is my work undertaken at the University of Ghana. This research has not been previously published by any other person or accepted for an award of degree in this university or any other university. However, prior research works consulted are duly acknowledged in the text. I, therefore, declare that I am solely responsible for any shortcomings of the study.

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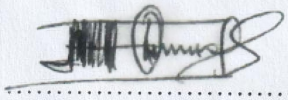
CERTIFICATION

I hereby certify that the preparation and presentation of the thesis were supervised following the guidelines laid down by the university.



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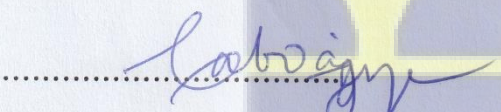

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DEDICATION

I dedicate this work to the Almighty God for granting me the strength, wisdom and resources that have brought me this far in my academic live.

I also dedicate this work to my mother, Madam Grace Foah and my siblings, Mabel Yeboah, Nana-Ahenkora Hagan and Awuraba Dede Hagan for their unabated support throughout these two years of academic journey. God bless you for the financial, moral and spiritual support given me during these two years of education

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LIST OF ABBREVIATIONS AND ACRONYMS

ERPs	-	Enterprise resource planning systems
IT	-	Information technology
CEO	-	Chief Executive Officer
BCB	-	Better Customer Bureau
IMA	-	Institute of Management Accountants
ICA	-	Institute of Chartered Accountants,
MoE	-	Ministry of Education
NGO	-	Non-Governmental Organizations
Wi-Fi	-	Wireless Fidelity
SPSS	-	Statistical Package for Social Sciences
SAS	-	Statistical Analysis Software
SQL	-	Structured Query Language
EPC	-	Electronic Parts Catalogue
BD	-	Big Data
HRMS	-	Human Resource Management System
IoT	-	Internet of Things
SMART	-	Smart, Measurable, Reliable and Time-bound
GIGO	-	Garbage-In, Garbage-Out
FD	-	Functional Dependency

ABSTRACT

Big data analytics is one of the reliable means of data management techniques used in most transnational corporations. In Ghana, there have been efforts by multinational companies to efficiently outsource, store, analyse and use big data for various decision-making protocols. However, accountants' low level of expertise in data management techniques has resulted in several challenges in big accessing, analysing, and making empirical decisions with big data.

This qualitative study employed the case study design while purposively sampling twelve respondents from multinational companies in Ghana to assess big data management techniques in multinational companies and the challenges that are associated with them. Data was elicited from respondents through face-to-face in-depth interviews with specially designed interview guide. Findings reported by the study revealed that, multinational companies in Ghana resort to the use of big data analytical systems such as Tableau, SAP, AQUILLA and EPC for data sourcing and storage. Moreover, it was revealed that accountants in multinational companies greatly depend on big data analytics for making various strategic, managerial, and financial regulatory decisions and analysis. Notwithstanding that, it was established that there are a wide range of adversities in using big data in multinational companies. Such of these challenges include data redundancy, privacy concerns and low level of expertise that make the application of big data in financial analysis, projections and decision making less accurate and reliable. In an attempt in overcoming such challenges, the study recommends that; multinational companies should invest in human resource training in order to equip staff with the needed sills to manage big data. Furthermore, analytical systems developers ought to update existing softwares in order to reduce data edundancy and improve data recovery.

Lastly, government in consultation with stakeholders should prioritize data privacy and hence ensure adequate advancement of technological infrastructure.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Information systems have evolved over time from a means of recording transactions to a means of making business choices at various levels. Traditional information systems, such as enterprise resource planning systems, rely heavily on internal data sources to make business decisions. Accounting should commonly be seen as an art because it involves methods intended to satisfy some specific ends, and the availability of intellectual resources are typically subject to a mechanism that leads to a gradual progression. Accounting has always responded to business needs with technical innovations throughout its growth. In response to business needs, for example, double-entry bookkeeping, a written manifestation of merchants' affairs, was created (Yamey, 1947).

According to Alles (2015), companies and organizations across Europe and the Americas have shown significant awareness of the importance of big data to the success or failure of accounting processes and enterprise as a whole. Businesses and organisations in Europe and the Americas have shown considerable understanding of the relevance of big data to the accomplishments or shortcomings of accounting practices and business, according to Alles (2015). In the global accounting climate, this has told numerous players and stakeholders to be very prudent in how they function and manage data, as this will have a significant effect on big data in global accounting in some way. Accounting and data have a heavy interdependence, which is a result of on-going business activities, and because of rapidly

evolving technology, auditing has seen progressive opportunities and challenges. Big data should be seriously adopted by auditors as a means of increasing the efficiency and reliability of their activities (Alles, 2015).

Auditing has been influenced by the growth of information technology (IT), thereby creating a contemporary phenomenon in the industry. In practice, auditors assess whether additional testing needs to be conducted to achieve both process and compliance-related results based on sampling testing followed by inferences derived from their professional judgment. Auditors use advanced expertise in addition to having the skills required to obtain and critically analyze audit evidence and the dedication to conduct tasks with integrity, and so communities view them as trustworthy (West, 2003). The recent developments in technological innovations in Africa that integrate the use of big data for accounting practices have created opportunities and challenges for the profession at the same time. In order to stay important to their communities in general and their customers, accountants must consider the impacts and risks of big data and aspire to learn the necessary technical skills.

Rapid IT movements also increased organizations' ability to capture, store, extract and use data. A growing number of businesses on the continent are getting better and more effective at structuring data, allowing knowledge to be integrated into more complicated models and algorithms. Professional accountants with a strong knowledge of computer-aided accounting approaches have the means to use data processing to enhance accounting programs or analyze plans through an audit. Describe computer-assisted accounting techniques may in basic terms, as computerized methods used to

process data by accountants. Big data includes the development of representative systems for analytics and distribution to monitor and view large-scale stored information (Singleton, 2013).

In the decision-making phase of the organisation, accountants and accounting professionals are now involved players. The increasing development of IT has also influenced accounting standards, thereby generating a contemporary pattern in the industry. Recent developments in technology advances integrating the use of big data for accounting activities have created opportunities and obstacles for the discipline at the same time.

Research conducted by PwC (2015) based on feedback from sampled groups of accountants, CEOs in the West African sub-region indicates that data collection, and interpretation is expanding at an unprecedented rate. PwC (2015) reported in its 18th annual CEO Report that big data and analytics are the second-most significant strategic technology for CEOs in West Africa, following mobile and wireless technology. 85% of the CEOs surveyed claimed that data analytics had a high benefit on their firms. In defining their technologies and policy, organizations are now using information from newly accessible data sources. In order to help a company better understand its industry and markets and make timely business decisions, data mining uses data for quantitative and/or qualitative analysis. Collecting and interpreting data from new sources has been a must for many companies in identifying emerging patterns and keeping it separate from rivals with better knowledge and data.

In Ghana, well-established accounting companies such as KPMG, BCB Consult, Price Water House and others are generally involved in practices

related to big data and accounting data mining. The diverse and nuanced nature of Ghana's market climate makes it very difficult for small-scale local accounting firms and experts to invest and venture for successful decision-making in big data and data mining (Amponsah-Tawiah & Dartey-Baah, 2011).

Recent literature, however, has disclosed that indigenous firms have increasingly engaged in big data and data mining operations in developed countries. In Ghana, the term "big data" has been used to identify data sets that are so broad that they need specialized technologies for data storage and visualization. The immense volume, high speed and vast range are features that differentiate big data from 'conventional' data and market analytics. The technology landscape has already evolved and will continue to evolve in the future, changing the general method of doing business and analyzing accounting and business knowledge. In the Ghanaian data dominated age of Ghanaian industry (CGMA, 2013), this is one of the main driving factors.

1.2 Problem Statement

Companies and other groups may benefit from the many opportunities Big Data presents (Hashem et al., 2015). Particularly in marketing, new avenues of analysis become available when considering things like consumer behavior and engaging with customers. These kinds of studies can incorporate not just structured data, but also unstructured data (such images, audio, and text files) (Bhimani and Willcocks, 2014). Businesses may now conduct real-time customer service analytics with the help of Big Data solutions' integrated analytics capabilities. As a result, businesses are more able to sway consumers'

choices during their contacts with them, thanks to the information provided by Big Data (Gandomi and Haider, 2015). Big Data has the potential to yield useful insights for a variety of corporate operations, not only marketing.

With the advent of big data and big data analytics, accountants have begun to abandon the time-honored practices of data collection, processing, and storage in favor of massive amounts of computer-generated and analyzed information (Ibrahim et al., 2021). Taking accounting as an example, social media is increasingly being used by accountants as a source of big data, which is part of a larger trend (Arnaboldi et al., 2017). Big data, data analytics, and the use of these techniques in the field of accounting are all in their infancy now. To date, studies have confirmed that skepticism exists regarding the veracity of the large and complex data gathered, the methods of processing it, the risks of using it, the place it has within organizations, the risk to the company's reputation, and the value of the information that would be generated if it were to be used (O'Leary, 2018; Jia, 2020; Bhimani and Willcocks, 2014).

The literature has discussed not just the potential benefits of Big Data, but also the various challenges that it presents. For instance, Davenport (2014) believes that although the new and widened alternatives for analysis may be novel, challenges may also show themselves, for instance, the automation of management-accounting functions (Frey and Osborne, 2013; Wimmes et al., 2015). Larger amounts of data do not automatically lead to improved decision making; therefore, the usage of Big Data may not have just beneficial consequences on the determination and provision of management-accounting information. To rephrase, there is always a chance that the most important or accurate information will not be gleaned from the available data. As a result,

accountants may provide misleading data to top management (Quattrone, 2016). Since one of management accounting's primary functions is to advise top management, Big Data has become one of the field's biggest concerns. Despite these challenges, existing anecdotal evidence and sample case studies demonstrate that accounting, the accounting practice and profession, and corporate responsibility have all been altered by big data and big data analytics. As a result, it makes sense to look into how big data and big data analytics have changed the nature of accounting.

More importantly, it should be acknowledged that big data and advanced analytics should be widely discussed in the IT, accounting, and academic sectors in every economy. However, the phenomena have received very little attention within the management accounting academy, despite the fact that big data has the ability to change managerial accounting and bring accountants into a more competitive position by supplying more current information at a quicker speed (Bhimani & Willcocks, 2014).

In Africa, however only a few studies have been carried out with none on multinational firms in Ghana. An example is a report by Akin-Odanye, Chioma and Abiodun (2011) who discovered that accountants face differing degrees of difficulties in obtaining big data. The results demonstrated that it was very difficult for accountants and other key players to easily and readily access or even develop big data. It was noted however that, accountants with some IT background, networking knowledge and higher education had a higher chance of accessing and developing big data. In Ghana, a study conducted by Adu-Manu and Gyamfi (2018), which among Ghana's few

telecommunications companies put great focus on big data sourcing and analytics.

In view of these issues, this work aims to figure out how accountants make educated decisions, using big data in different multinational corporations in Ghana. Moreover, the researcher anticipates that, accountants' better understanding of big data and its management as well as its role in decision making may improve the quality of tactical, strategic and operational decisions of accountants while ensuring the cost-effectiveness of demand and supply forces in the sectorial model. This study however is conducted to reaffirm or disproof these points earlier asserted.

1.3 Research Objectives

The general objective of the study is to explore the contribution of big data in decision making by accountants in multinational companies in Ghana. Some specific objectives relating to the study include:

i. Investigating big data management techniques by accountants in multinational companies in Ghana.
ii. Exploring how accountants in multinational companies utilize big data in making decisions.
iii. Assessing the challenges of big data management by accountants in multinational firms in Ghana.

1.4 Research Questions

The study was premised on answering the following pertinent questions:

i. What techniques do accountants deploy in managing big data in multinational firms in Ghana?

ii. How do accountants in multinational companies in Ghana utilize big data in the decision-making process?

iii. What are the major challenges that accountants in multinational companies face in managing big data?

1.5 Significance of the Study

Though this study was conducted for academic purpose, the researcher envisaged that findings and results would be shared with University of Ghana Business School, the Institute of Chartered Accountants, Ministry of Education, appropriate Governmental agencies, Non-Governmental Organizations and Advocacy groups as well as small, medium and large scale businesses in order to help in educating and informing various directives, policies and decisions regarding obtaining, storing (managing) and usage of big data in the accounting fraternity. The research was also done to add to the already existing literature in academia in the Ghanaian and African context in disciplines such as accountancy, business management, auditing and decision making in businesses. The novelty of this research was to explore the perceived use of big data for decision making among accountants. This study was to further improve and contribute to what determines and affects differences in interpreting big data and decision making in developing countries. To practice, it was to broaden the understanding of accountants on how to efficiently manage and utilize big data in making informed tactical, operational and strategic decisions.

1.6 Limitation of the Study

Though this study was conducted to investigate how big data is used to make accounting decisions in multinational companies in Ghana, the researcher envisaged a few huddles in the conduct of this study and hence adapted cost–effective and efficient measures to address them to ensure successful conduct of the study. Primarily, the scope of the study area (Ghana) coupled with time and resource constraints was a major challenge which made it uneasy to involve all accounting multinational companies in Ghana in the conduct of the study. In addressing this, the researcher sampled an appropriate number of accounting firms for data collection. It was anticipated that, the homogeneity of the companies regarding the management and use of big data for decision making was enough reason to use the findings from the selected companies for further discussion and analysis. Moreover, data collection from the target group was challenged in the conduct of the study. The researcher considered the busy schedules of accountants and the high level of data privacy in the firms in the pre–test stage of the study. In correcting this, the researcher familiarized himself with the target group and fore–booked interview appointments with them which facilitated smooth data gathering procedure in the conduct of the study.

1.7 Definition of Terms

Several terminologies are defined based on their contextual meanings and or the functions they perform in this work rather than their respective basic meanings. However, in the context of this study, it is prerequisite to outline and define the candid meanings of various terminologies pertinent to the

subject matter under study. Some of these terms are defined in subsections below.

1.7.1 Big Data

The huge quantity of data constantly collected by devices and technology like as credit cards and customer loyalty cards, the internet and social media, and, increasingly, Wi-Fi sensors and electronic tags is referred to as big data. Many of the records are unstructured (data that does not follow a pre-defined data model), while others are structured or semi-structured.

1.7.2 Decision Making

A viewpoint, attitude, or conclusion acquired through inquiry or examination of a situation is referred to as decision making.

1.7.3 Analytics

These are specific professional experiences, programs and tools used in the management and analysis of big data. They include statistical tools such as SPSS, SAS and SQL.

1.7.4 Analysis

This involves capacity development of insight from big data using analytical tools by accountants for decision making.

1.7.5 Information Technology (IT)

This is the use of computers and computing devices to store, retrieve, transmit and manipulate data or information, often in the context of business or other enterprises. Alternatively, the term is used to describe the creation of computer

systems and applications, especially those that move data around a computer network, between clients and servers or the internet.

1.7.6 Accounting

Accounting is the practice of keeping track of a company's financial activities and records. Transactions are recorded, summarized, analyzed, and reported to oversight authorities, regulators, and tax collecting bodies as part of the accounting process.

1.7.7 Accountant

An accountant is a professional who documents commercial transactions on behalf of a firm, provides management with performance reports, and prepares financial statements.

1.8 Chapter Disposition

This study will be organized into five chapters. Chapter one, which is captioned as introduction, entails the general background to the study. It also covers the problem statement, objectives, and research questions. Moreover, the chapter reveals the significance, limitation as well as the chapter organization of the study. Chapter two, dubbed literature review, focuses on the review of relevant empirical literature, conceptual and theoretical frameworks pertinent to various variables in the topic. In Chapter three, the researcher discusses the research methodology of the study. It covers aspects such as research design, study area, target population, sources of data, sampling techniques and size, instrument for data gathering as well as data gathering procedure and ethical considerations. However, chapter four

presents the findings of this study while making empirical discussion and analysis of the correlations that exist between various objectives, facts already cited in other literature as well as elements in the conceptual framework. The Chapter five of the study entails the recommendations, summary and the conclusion of the entire study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on relaying the empirical lens on the theoretical and conceptual frameworks as well as the review of related literature (as already reported by other scholars) which are in line with this study. The review of such literature reveals the similarities, differences and correlations among various variables and aspects of the problem and hence brings out the gap for this study to lay much emphasis on. Tentatively, literature in this chapter is reviewed thematically (based on specific and distinct themes or terminologies). However, the structure of the thematic approach in the review of literature in this chapter covers themes such as are outlined below: the concept of big data, Big data management in accounting, Role of big data in decision making, Challenges of big data and the role of accountants in decision making.

2.2 The Concept of Big Data

Various scholars to mean distinct aspect of a similar phenomenon in accounting subjectively use the term. Therefore, the phrase "big data" has become widely used in the corporate world (Davenport, 2014; McAfee &

Brynjolfsson, 2012; Bhimani & Willcocks, 2014). Data sets that are so huge and complicated that new data management and visualization tools are required have been dubbed "big data." Volume, variety, and velocity are the three Vs that define the phrase and distinguish it from the larger concept of business analytics. Volume relates to the database's size, variety to the vast range of data kinds, and velocity to the rate at which data is added. These three characteristics have been used to characterize big data as a whole (Chen et al., 2012).

However, Crawford (2012) defined big data as cultural, technological and scholarly phenomenon while Fan (2014) also defined big data as the ocean of information and client – data resourceful for auditing. Moreover, Kitchin (2014) indicated that big data is defined as huge volume of structured and unstructured data. From the viewpoint of Kitchin, such data exist in two main dimensions; that is structured (data analysed in a specific format and trend) and unstructured (often too huge and large to analyse, hence existing in its unprocessed form).

Waller and Fawcett (2013) define big data as datasets that are too huge for standard data processing methods and hence require new technologies to process. Waller & Fawcett further indicated that, such datasets are too large, volatile and are of too great value to be able to be stored, managed and analysed by traditional (primitive) systems of data management. From their viewpoint, big data require more technical and tactical models in its definition, management and utilization.

On the other hand, Dubey (2015) perceive big data as a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis while a study conducted by Dyche (2014) revealed that, the concept of big data for many people is just millions of data which can be analysed through technologies. Big data in true sense is the proper use of data through technologies in any aspect. More specifically, he believes that big data emerged in the first years of the twenty century, and that it was adopted initially by internet and start-up businesses. A new form of data has emerged, including speech, text, log files, pictures, and videos. When big data is used correctly, it may be used in a variety of ways to aid decision-making. According to Dyche (2014), a variety of approaches and technologies may help businesses make better decisions. According to Dyche, the notion of big data originated when companies like Amazon and Netflix created algorithms to identify correlations between consumer searches and previous purchase histories in order to forecast which goods customers are likely to buy. Clients were reminded of previous searches or given product recommendations based on their purchasing history. Customers were able to purchase some of the suggested goods, resulting in increased sales. As much as a third of their new sales came through this method (Artun and Levin, 2015). Telecom firms sift through vast amounts of data to forecast which consumers will be most likely to ignore them. This aids in the development of client retention policies.

In recent years, several contemporary definitions of the concept of big data have emerged. However, no scholar is able to clearly define what actually does or does not qualify to be referred to as big data. In the same vein, little

knowledge regarding the actual time frame within which big data is known to have emerged exists in modern literature; which makes the etymology of the concept of literature varying. Regardless, according to Yang (2017), big data refers to a flood of digital data (texts, geometries, pictures, videos, sounds, and combinations of each) originating from a variety of digital sources, such as sensors, scanners, digitizers, the internet, mobile phones, e-mails, and social networks. From the perspective of Yang, big data does not only entail the greater accumulation of chunk of customer data but rather, it entails every bit of data as well as the combination of diverse data formats; existing in a great volume.

Big data, according to Thota et al. (2017), is information assets with a large volume, variety, and velocity that necessitate novel cost-effective information processing to provide greater insight, process automation, and decision making. The additional recipe to Thota's definition of big data is the ability to characterize what constitutes big data; with volume, variety and velocity. He further reiterated that, the high volume, diverse variety and high velocity of big data makes it require so much of innovative and cost-effective information processing techniques in its management in utilization rather than the usual primitive methods (book records). Moreover, he added that the concept of big data is entrenched on facilitating better insight and decision making (comparatively). Whereas the phrase "big data" is new, collecting and storing massive volumes of data for later analysis is not. When industry expert Doug Laney coined the now-common description of big data as the three Vs in the early 2000s, the notion gained traction. - Velocity, Variety, and volume. Laney

further indicated that, any dataset characterized by having enormous volume, velocity and variety constitutes big data in accounting.

Big data, according to McKinsey (2019), is defined as datasets that exceed the capabilities of traditional applications and technology to manage and analyze the data. The human imagination is likewise challenged by big data. While some may consider a few dozen terabytes to be huge data, others may not. Even though it is a huge dataset, it may be handled and stored using a collection of disks in a local network attached storage (NAS) or storage area network (SAN). Big data, in general, is thought to be petabytes in size, necessitating the use of a complex distributed computing and storage grid, as well as sophisticated applications and tools, to handle it. Big data refers to the infrastructure and technology that businesses employ to gather, store, and analyze numerous forms of data from a process standpoint. Given the difficulty of designing, building, implementing, and managing big data, it is critical to look into the reasons for big data adoptions as well as the human competencies required.

Deducing from the above literature, big data can be defined as having a bigger range of data types, arriving in growing volumes, and moving at a higher velocity. This concept is frequently referred to as the "three Vs." To put it another way, big data refers to data sets that are bigger, more complicated, and in particular come from new data sources.

2.3 Components of Big Data

While most authors have varying definition and categorization of big data in accounting, there seems to be a fixed and systematic characterization of the

concept of big data based on the recognition of well–developed components. Notwithstanding this, some scholars refer to these components as the Three Vs while others perceive them as the Five Vs. When the phrase "Big Data" originally appeared, it signified either information management or information processing, as per Gaertner (2018). Both processes are now characterized by rising data volume, diversity, and velocity of data production.

In a research, Assunçao et al. (2015) said that big data is defined by a multi-V model. Volume, velocity, value, and diversity are all part of the model. Aside from this, a component called truthfulness has been found. A large amount of data is referred to as volume. The rate or pace at which data is created and processed is referred to as velocity. The term "variety" refers to the wide range of sources and data kinds available. Finally, veracity relates to the data's integrity and dependability. In a similar vein, Yogesh and Shirish (2018) discovered that the components (five Vs) of big data are considered as features of big data since they represent the dataset's dimensions, regularity, and value. In Table 2.0, they go through these elements in more detail.

Characteristics	**Description**
Volume	Large amount of Data in terabytes or petabytes has been doubling every forty months (Davenport, 2014)
Velocity	Rate of Data accumulation is increasing in every business or organization
Variety	There are multitude of Data Sources like enterprise systems, social media, text, video, audio, email, RFID, web applications and other digital devices.

Veracity	Quality of Data is very essential for the accuracy of decision.
Value	Economic & Social Outcomes can be improved by obtaining value from the heterogeneous data

Table 2.0: Five Vs of Big Data

Source: Yogesh and Shirish (2018)

2.3.1 Volume

Big data, according to Gaertner (2018), is among the most pressing difficulties of Big Data. More information travels the internet every second than was kept online 20 years ago, as per McAfee and Brynjolfsson (2012). As a result, the quantity of data available has risen exponentially and continues to do so, necessitating the provision of sufficient storage for such massive volumes of data.

Borne (2013) estimates that mankind created roughly five exabytes of data between the birth of written language and 2003. Every two days, the same quantity of data was produced in 2011. Every 10 minutes in 2013, the same quantity of data was produced. This is due to the fact that today's businesses collect information from a variety of sources, including application logs, machine data, weather data, clickstream logs, emails, geographic information systems, contracts, and geographical data, survey data, spread sheets, reports, and social media. The capacity to compute huge amounts of data is the most important aspect of big data analytics. Storage technology, processing capacities, and database models are all limited by large amounts of data.

Dumbill (2012) claims that big data offers an immediate challenge to standard data storage architecture since it necessitates scalable systems and distributed querying. It also poses a challenge to conventional databases, which are incapable of handling enormously parallel processing and unstructured indexing. For large data analytics, computational capacity is equally crucial. As per Hilbert and López (2013), the scale of data sets has outgrown computational capabilities. In 2007, mankind could store around 2.9 1020 bytes and perform approximately 6.4 1018 instructions per second. It's worth noting that a byte must be processed by a general-purpose computer using more than three instructions (Hilbert and López, 2013).

2.3.2 Velocity

Velocity was described by Brands (2014) as the speed of data collection, processing and analyzing. An colossal 2.5 million terabytes of data is generated annually, according to IBM. Therefore, in order to operate agilely and remain competitive, businesses have an increasing need for real-time analytics.

Studies according to Cukier (2015) show, however that the world produced around 5 exabytes per 10 minutes in 2013. The inferences made by Cukier show that velocity is the frequency of big data accumulation in companies from various sources (electronic and manual). It is fair to conclude that five exabytes are likely to be generated per minute or so today. A parallel rate to that of volume has accompanied the significance of data velocity as the influx of data through organizations grows at accelerated rates. For example, Wal-Mart produces around 2.5 petabytes per hour (or 5825.42 gigabits per second), according to Cukier (2015). Up to 100 gigabits per second (0.043 petabytes

per hour) will be transferred by the most effective media for data transfer, that is, fibre optic cable (Cukier, 2017). Simply put, Wal-Mart generates more information than it can transfer to a single data center. Data velocity, however, not only threatens networking networks, but also continuous data stream inflow transmission capacities (Brands 2014). According to Dumbill (2012), some degree of processing is required to maintain the level of storage realistic during the inbound results. This can involve strips of on-the-fly files, compression or realistic material. For example, the Large Hadrons Collider (LHC) produces fewer data than can be processed by the CERN computing grid; data must then be evaluated instantly (2014). This problem seems to be straightforward, but real-time analytics challenges traditional parallel and distributed computation (2014).

2.3.3 Variety

A variant of big data is the heterogeneity of the data form (Gandomi and Haider, 2015) resulting from a wide range of big data sources such as sensors, the internet, telephone transfers, social media, and signals from the global positioning system (GPS). These sources include structured, unstructured, semi-structured, (data with no specific format) and multi-structured data (Ishwarappa and Anuradha, 2015). Only around 5% of all currently recorded data is saved in a hierarchical structure (Gandomi and Haider, 2015).

In most cases, traditional information architectures rely on well-organized data. In order to generate usable outputs (lists, reports, forecasts, and so on), inputs must be entered correctly into the system. Multiple data sources, such as sensor data, device logs, clickstream logs, weather data, communications,

contracts, geographic data, surveys, spreadsheets, and social media, are tough to manage. That is, converting data from many domains into a structured format is very difficult (Dumbill, 2013). Because big data is both varied and unstructured, it necessitates the use of tools and processes that go beyond standard information systems and relational databases.

Data diversity is a common case for big data applications, according to Dumbill (2012) and Kambatla et al. (2014), and the frequent application of big data analytics is to understand unstructured data and to locate useful knowledge. The static design of relational database schemas is not appropriate for a complex and exploratory environment, even where there is no substantial mismatch in the data form (Dumbill 2012, p. 13). Big data systems require multiple computing resources for processing text, image, video, audio, geo-spatial data, etc. that are not available in conventional databases.

Based on these three Vs, two more Vs have recently been proposed as significant characteristics of Big Data (e.g., Ishwarappa and Anuradha, 2015), leading to a five-V definition of Big Data that includes the three aforementioned plus "veracity" and "value":

2.3.4 Veracity

This is the element of data that could be faced by enterprises concerned with big data. The accuracy of data depends on the source, but information is rarely 100 percent accurate. As a consequence of contradictions, incompleteness and uncertainties, data quality suffers (Brands, 2014; Gandomi and Haider, 2015; Hashem et al., 2014; Ishwarappa and Anuradha, 2015). Therefore, it is important to test data veracity when working with big data. However, data veracity was viewed by Shirish and Yogesh (2018) as real, accurate and

consistent data content. They further explained that the feasibility and adequacy of decision-making in businesses are primarily dependent on the reliability and validity of data, hence veracity.

2.3.5 Value

Profit is the most significant feature of Big Data for some writers (Ishwarappa and Anuradha, 2015; Hashem et al., 2015). “Worth" refers in this respect to the course of discovering from large datasets something useful." In general, access to vast volumes of data can also appear beneficial because data may have a high potential for utility, but distilling usable data from huge databases may be difficult (Brands, 2014; Ishwarappa and Anuradha, 2015; Hashem et al., 2015).

Yogesh and Shirish (2018) suggested that when it comes to big data, alleged data analytics company SAS finds two extra measurements, such as uncertainty and sophistication.

2.3.5 Variability

Data flows can be particularly inconsistent with seasonal peaks, in addition to increasing data rates and ranges. Is social media more of a trend? It can be difficult to handle regular, seasonal and event-triggered peak data loads, and more so with unstructured data (Shirish and Yogesh, 2018).

2.3.6 Complexity

Yogesh (2018) reiterated that today's knowledge comes from numerous sources, making it difficult for systems to connect, fit, clean and turn data. However, partnerships, hierarchies and various data links need to be interconnected and correlated, or the data will degenerate out of reach easily.

2.4 Sources of Big Data

Big data is a wrapper with multiple granular data types as well. Five primary high-volume data sources are listed below: (1) public data, (2) private data, (3) data exhaustion, (4) group data and (5) self-quantification data as classified by the Academy of Management Journal (2014).

2.4.1 Public Data

According to the Academy of Management Journal, a public source of data is one that is generally owned by governmental organizations, governments, and local communities and may be used for a variety of business and management purposes. Transportation, energy consumption, and health care data are examples of such data that are accessible with specific limits in order to protect individual privacy.

2.4.2 Private Data

These are private data maintained by private companies, non-profit organizations, and people that represent personal information that cannot be easily attributed to public sources. Consumer transactions, radio-frequency identification tags used in institutional supply chains, movement of corporate goods and resources, internet surfing, and smartphone usage, to name a few examples of private data, are all examples of private data.

2.4.3 Data Exhaust

The Academy of Management Journal (AMJ) in a 2018 publication referred exhaust data to the initial data-collection partner for ambient data that is passively gathered, non-core data with minimal or zero meaning. These data

have been gathered for a certain purpose, but to establish new sources of value, they may be recombined with other data sources. When people embrace and use emerging technology (e.g., smart phones) as by-products of their daily lives, they produce environmental data. Individuals can often passively relay knowledge when they go through their everyday lives (e.g., when making transactions, including informal markets; when receiving basic health care; or when engaging with others). Information-seeking behaviour, which can be used to assume the wishes, preferences, or intentions of individuals, is another cause of data fatigue. This entails online searching, mobile hotlines or other forms of private contact centres.

2.4.4 Community Data

The Academy of Management journal (2014) defines community data as the distillation of unstructured data, particularly text, into dynamic networks that reflect social patterns. Consumer evaluations of items, voting buttons (such as "I find this review beneficial"), and Twitter feeds are all examples of common community data. The significance of this community data may then be extracted to identify patterns in social structure (e.g., Kennedy, 2008).

2.4.5 Self-quantification Data

According to Kennedy (2008), these datasets are categories of data that are exposed by the individual by the quantification of personal behaviour and behaviors. A common type of self-quantification data, for example, is that collected by wristbands that measure exercise and movement, data that can then be monitored and aggregated by uploading to a cell phone program. People have stated preferences in psychology for what they want to do and " revealed preferences," where the desire for an action or activity is implied. For

example, with the intention of saving power, a person may purchase energy-efficient light bulbs, but still leave the lights on longer so they now consume less energy. Such data on self-quantification seeks to cross the link between behaviour and psychology. Social science scholars from diverse areas, such as psychology, marketing or public policy, could benefit from stated and implicit preference data for use in their research.

2.5 Big Data Ethics

O'Neil (2002) presents a number of examples of algorithmic-driven judgments based on flawed models that offer skewed or unequal results. Models usually rely on a variety of knowledge to identify entities based on correlations, and use the classification to make assumptions about the potential actions of people. Some of the common concerns underlined include:

- Not enough evidence to be valid statistically;
- A lack of feedback loop to pick up faults or environmental changes;
- Opaque data use, often using confidential data which otherwise would not be permitted;
- Confusing causation-related correlation; and
- Using inexpensive and easily usable material, rather than data that is most important but difficult to collect.

Additionally, according to O'Neil (2002), these difficulties lead to models and decision-making that discriminates against disadvantaged populations in areas such as criminal justice. As players test out different gaming systems, it might have a big influence on their behavior. She cites university rankings in the

United States as an example of how the data used in the process encourages colleges to spend a lot of money on sports facilities, for example, while providing no incentives to keep prices reasonable.

2.5.1 Automation

The third large use of big data draws on these statistical capacities to simplify routine and non-routine decisions and functions, according to a report published by Artificial Intelligence and the future of accountancy (2019). They also explained that there has been a lot of attention for driverless vehicles as the technology has advanced steadily in recent years.

They use a variety of data from navigation tools, sensors, satellites, and other sources to navigate their path, and their decision-making is getting increasingly accurate. Indeed, they are employed to increase road safety because they reduce the hazards associated with human weariness, carelessness, and poor-quality driving.

In addition, O'Neil (2012) has noted that in the Western world, in professions such as law and medicine, we see increasing specialization, as computers take on more roles that were historically difficult to computerize on the basis of predefined laws. For instance, in areas such as medical diagnosis, healthcare enterprises are beginning to exploit machine learning techniques. Computers can store much more information than humans and can work rapidly and reliably to determine the most plausible cause across potential explanations depending on the current symptoms. Models can comb through large quantities of possible facts in the legal profession even quicker and more reliably than humans.

Automation has a growing influence on accountancy as well. Significant aspects of bookkeeping and enforcement work are being automated, and machine learning approaches will allow automation of much more difficult and less traditional tasks.

2.6 Big Data Analysis and Management

Owing to the huge rise in the amount of data, big data analytics is distinct from conventional analytics; and this made many researchers propose many commercial Database Management Systems (DBMS) for the collection and management of big data. However, in recent years, these DBMS have not proven to be ideal for data size. Using standard relational database management systems, this form of data is difficult to accommodate. New creative technologies were needed, and by using a processing model called MapReduce (Cathy ONeil, 2002), Google found the solution. There are more options for managing big data, but Hadoop, an open-source project built on Google's MapReduce and Google File System, is the most commonly used one. The Apache Software Foundation developed Hadoop. Yahoo, Citrix, Facebook, Google, Microsoft, HP, IBM, Cloudera and several more are the key contributors to the project. Hadoop is a distributed batch processing infrastructure which consists of the Hadoop Distributed File System (HDFS), Hadoop kernel, MapReduce and several related projects.

2.6.1 Data Mining Analysis

The technique for extracting valuable information from the database is widely known as data mining. It is almost difficult to extract the value from each data directly. For this purpose, pre-processing and analytical methods for finding value are needed for data mining. Data mining, in fact, is closely linked to artificial intelligence and machine learning, etc. In data processing and big data, the scope of data storage varies greatly in complexity. The basic approach for extracting value, however, is quite similar. In the case of data mining, data cleaning, data integration, data collection, data transformation, pattern evaluation and information presentation are required in the process of extracting knowledge. Since overcoming the specifications and problems of data processing, big data came out. The processing of multiple types of data, the reliability and scalability of data mining algorithms and the mining of information from different data sources are requirements and challenges.

2.6.2 Big Data over Cloud Computing

Cloud computing is typically defined as a type of computing that uses shared data pooling resources instead of local servers or personal computers to handle applications. Both new technology, such as the cloud computing infrastructure and grid, have been developed to access vast volumes of computational resources (software, hardware,) and deliver them in a single machine view. Cloud computing has transformed the way data technology is abstracted and used, becoming the dominating architecture among these advances for large-scale and dynamic computing. In addition, the key purpose of cloud computing is to provide computing, such as high-dimensional data collections, large sizes and multi-media, as a solution for addressing big data. There are

many leading manufacturers of IT solutions that provide consumers with these services. Now, as the notion of big data has been more widely accepted, the cloud computing service model is gradually evolving into a big data service model, which are BDaaS (Big data as a Service), AaaS (Analysis as a Service) and DaaS (Database as a Service).

2.6.3 Hadoop HDFS and MapReduce

Hadoop comes with a distributed file system that is Hadoop's default distributed file system. It stores the files in 64 MB blocks. It is capable of storing files of various sizes from 100 MB to GB, TB. The Hadoop architecture includes Name, Data, Secondary Name, Mission, and Work Tracker nodes. Metadata information about the block contained in the Hadoop distributed file system was kept by the Name node. In a distributed way, files are stored in blocks. The secondary name node is responsible for maintaining the name node's validity as well as updating the name node's information from time to time. The data is saved in Node Storage. The Task Tracker takes the work of the user and divides it into parts. The Task Tracker is then applied to these individual jobs via the Work Tracker. The Mission Tracker is based on the Data node, and it is here that the data is retrieved and the job is completed. They are continuously chatting with the Career Tracker. The Task Tracker keeps track of the jobs that the user has submitted. The Job Tracker has a certain amount of slots available for jobs to be completed. The Work Tracker selects a role tracker with available slots. It's a good idea to put the Job Tracker on the same rack as the data. Rack perception is the term for this. This can be accomplished by reserving inter-rack bandwidth. The Work Tracker demonstrates that Hadoop's different components are organized into a single

node structure. In this configuration, the Name Node, Secondary Name Node, Data Node, Work Tracker, and Activity Tracker modules are all located on the same device. The user turns in his work in the form of a MapReduce assignment. Because the data node and the job tracker are on the same device, reading and writing may be done at the fastest feasible speeds. Map-Reduce was developed by Google in order to process and store large datasets using commodity hardware. It provides a programming framework that allows for the usage and management of a wide range of computer-intensive operations. As a result, several computer languages now have Map-Reduce implementations, allowing them to reach a wider audience. Hadoop, on the other side, is a widely used free Apache Foundation Map-Reduce implementation. With the popularity of the Hadoop apps, the open-source community has created a number of supplementary applications that have been packaged under the apache foundation. As an analytic, Map-Reduce contains two primary components, namely;

1) Map operation: This is where a basic function is used to issue parallel key/value pairs, such as having primary keys in the field of relational databases. When the data to be processed is mapped into key/value classes, it allows the intermediate data to be aggregated before moving it with a feature called "combiner".
2) Reduce operation: This is used to apply the core processing logic to produce results in a timely manner. The simple concept of Map-Reduce removes many traditional challenges in High Performance Computing (HPC) to achieve fault tolerance and availability. Therefore, it paves the

way for development of highly parallel, highly reliable and distributed applications on large datasets.

2.7 Big Data Awareness

In the growing enlightenment and understanding of big data processing, management and use, numerous scholars have made earnest attempts to locate the sources. Adu-Manu and Gyamfi (2018) have demonstrated how information systems have evolved over time from being a transaction monitoring tool to assisting business decisions at different stages. Traditional information systems, such as enterprise resource planning systems, rely on internal data sources to make business choices. From their perspective, the relational database management system structured and utilised these datasets (RDBMS). Internal market decisions such as pricing decisions, asset control, identifying the most lucrative clients, and product loss-making recognition, among others, were made easier with this. Furthermore, the data warehouse was built with this data in mind for research and mining. These data sources were integrated with information from industry partners, such as suppliers and clients that use networks to integrate corporate applications (EAI). EAI has made it simpler for business partners to seamlessly combine information technologies. It improved the speed and connectedness of business transactions (B2B), as well as the cost of inter-company transactions.

In the early 1990s, Willcocks (2014) said that the introduction of the Internet made it easier for firms to integrate with their corporate partners. Over the last decade, huge amounts of data have been generated through information networks linked with the internet, cloud computing, smart devices, and the

Internet of Things (a network with physical purposes), sometimes referred to as big data. It includes data warehouse construction, OLAP, ETL, and real-time structured, semi-structured, and unstructured data.

Willocks (2014) found that computer science has progressed to the point where it can now store and analyse enormous amounts of different datasets using statistical approaches.

The big data revolution is far more powerful than previous analytics methods. Rather of speculating based on specific facts, managers may use big data to make educated decisions. Big data provides for more accurate forecasts and wiser decisions by gathering far more data than is necessary for any one application (McAfee et al., 2012). Executives from many industries utilize big data to improve their company operations. Many research have been conducted in a variety of sectors, including social media data, transactional data, big data supply chain, and so on. Decision-makers still don't understand the benefits of big data due to a lack of comprehensive analysis. Willcocks (2014) investigated the role of large data variety in several decision-making situations, guided by this requirement. The research conducted by Willcocks added further by concentrating on:

a) Examining the current literature on big data's core ideas and function in decision-making

b) Investigating the use of big data in tactical, strategic, and operational decision-making.

Big data has been used in many enterprise and education fields throughout the current period. This has contributed to accurate forecasts and better choices

being made. On the other hand, among analytics experts, Gaertner (2018) reviewed multiple knowledge stages in big data. He revealed that the use of analytics in big data decision-making is nothing new for some of the world's most prestigious companies in the Americas. There are already, however, many small and medium-sized firms that can continue to take advantage of this emerging field.

Exponential data increase is triggered by digitalization and the comprehensive extension and usage of the internet, with overall data volume, according to projections, rising to around 100 zettabytes by 2022 (Fox and Do, 2013; Brands, 2014). In order to capture, maintain and process this vast volume of information, technology and methods that are also referred to as Big Data, targeted use of suitable technologies and methods would also be required (Davenport, 2014; Gänßlen and Losbichler, 2014). Big Data is defined as a sort of management revolution by both Manyika et al. (2011) and McAfee and Brynjolfsson (2012). Companies will be able to handle a vast volume of data using Big Data technology, have more detailed predictions and make smarter decisions (McAfee and Brynjolsson, 2012). Big Data's distinguishing features include not only the real-time administration of enormous, rapidly rising datasets, but also the analysis of any data type and various data systems that previously had to be processed and evaluated separately (Gandomi and Haider, 2015; Brands, 2014).

Big Data will also give diverse opportunities to businesses and other organisations (Hashem, 2015). When examining consumer behavior and engaging with customers, for example, new research possibilities develop, notably in marketing.

This evaluation may include both organized and unstructured data (e.g., photograph, audio and text files) (Bhimani and Willcocks, 2014). Furthermore, analytics tools used with Big Data applications help businesses to analyze data in real-time when in touch with consumers. Thus, businesses are increasingly able to manipulate consumer choices during customer transactions, based on Big Data (Gandomi and Haider, 2015). Big Data may give helpful knowledge to other company departments in addition to processing customer-related data for marketing reasons. Among them, the use of Big Data for management accounting is now under discussion, owing to the strong relationship between information systems (IS) and management accounting.

The widespread use of ERP systems for management-accounting objectives, as well as the critical role played by management accountants as key users in the introduction and use of such systems, demonstrate the close relationship between IS and management accounting (Gärtner and Duller, 2015; Granlund and Mouritsen, 2003). Management accountants also have considerable experience managing massive databases, not least for this reason. Much as for ERP schemes, it is also possible to extract valuable knowledge from Big Data for management accountants.

In the meantime, many researchers around the world are firmly disposed to gather, store and even exchange data on individuals, enterprises and other government units on an on-going basis. Businesses of their suppliers, consumers and/or other organizations are now doing the same. Indeed, with the fast expansion of social networking sites like Facebook, Twitter, WhatsApp, and LinkedIn, millions around the world are constantly posting

and shopping messages, photos, and videos. As a result, massive amounts of data are generated and shared all over the world (Agarwal and Dhar, 2014). According to Dobre and Xhafa (2014, p.46), the world creates about 2.5 quintillion bytes of data per day (i.e., 1 Exabyte is equivalent to 1 quintillion byte or 1 Exabyte is equal to 1 billion gigabytes).

According to Gantz and Reinsel (2013), by 2020, this data will have grown to 40 Zettabytes. As a result, with the massive rise of data throughout the world, the need to take advantage of and produce value from data and information becomes a major issue for business success (Olszak, 2016). Without a question, the idea of large data has significantly arisen with this immense volume of composite and complex data.

While its origin remains unknown (Gandomi & Haider, 2015), "big data" is everywhere at present, and it is assumed by Hashem et al. (2015) to have arisen as a commonly accepted trend. Diebold (2012 p.16) suggests that the word "big data" actually emerged in Silicon Graphics Inc. (SGI) lunch-table discussions in the mid-1990s, where John Mashey featured prominently. The present buzz can be attributed, according to Gandomi and Haider (2015), to the advertising campaigns by IBM and other leading technology firms that have invested in developing the market for niche analytics.

Big data is popular, yet it's not well understood. This mostly relates to the massive amounts of data created on a regular basis by gadgets and technology, also including consumer loyalty cards and credit cards, the internet and social media, as well as electronic tags and Wi-Fi sensors. The preponderance of this information is 'unstructured,' which means it does not follow a pre-determined

data model. Big data has piqued the interest of academics and experts in the accounting and business fields, and research shows that firms who use Big Data outperform their competitors (Dobre and Xhafa 2016). It should be highlighted, however, that 'more' data in and of itself does not bring any benefits; rather, how businesses make sense of data and obtain insights from studying it is crucial.

2.8 Big Data Application

The definition of big data, as mentioned above, refers to a vast dataset that threatens the existing technical environment in terms of scale, speed and variety. Big data's biggest task is not to store exponentially vast volumes of diverse data, but to make sense of and transform unstructured data into actionable information. Big data will offer valuable insights to guide informed decisions, according to Hilbert and López (2011). Daniel (2015) proposed a three-part conceptual structure for explaining big data in higher education: utilize the framework to describe, link data structures to coordinate the literature accessible, and construct a research design to help frame a variety of research techniques. Furthermore, Assunco (2015) addresses how large data threatens additional concerns outside storage, such as governance, data processing, and analytics.

Companies now create a large quantity of data as a result of developing technology and gadgets, allowing them to collect an increasing array of logs, databases, sensor records, trackers, and other data. Indeed, social media is a significant source of big data, because a single user may upload terabytes of

data every month by posting thousands of tweets and exchanging information with others. The infrastructural criteria for big data analytics are a) high output; (b) linear scalability; (c) high degree of parallelism; (d) error tolerance and auto recovery; and (e) distributed processing of data (Daniel 2016) to satisfy this scenario.

As per Philip Chen and Zhang (2014), big data is defined by its quantity, diversity, velocity, and significance. Advanced IT technologies, social media platforms, and corporate information systems are all actively creating enormous amounts of structured and unstructured data, and businesses are quickly finding it challenging to manage and profit from it. As per a paper published by Philip Chen and Zhang (2014), the concept of big data is comprised of high-tech data gathering, control, analysis, and visual technologies. Narayanan (2014) recognized that big data is both an object and a process in his research. Big data, according to the study, necessitates a volume of data that is generally inaccessible using traditional database and technical approaches. Some are internal, while others are worldwide, and they come from a variety of sources. Big data typically uses structured data, which is structured information, gathered through relational databases, spread sheets, and computers. Unstructured data, such as emails, messages, and voicemails, is dynamic information that is not stored in a permanent location. Semi-structured data does not have defined fields and instead uses tags or other identifiers to collect data components (HTML and XML-tagged texts are examples).

Big data implementations are widespread in many sectors, according to Gorten (2015), as technology has become more available and simplified. Brock and

Khan (2017) noted in their work on big data analysis that since information has become a highly valued asset throughout the world, data collecting and study on large and cloudy data has grown in popularity. According to a McKinsey Global Institute research (2014), big data refers to databases whose complexity exceeds the capabilities of standard database processing technologies to capture, preserve, handle, and analyze them. Different tools are meant to influence corporate decision-making, improve process performance, discover new innovation sectors, and include people in the process of policy research, planning, and implementation, according to a study performed by Krishnamurthy and Desouza (2015).

2.9 Big Data and Ghana's Economy

The planet has entered a point where there is knowledge all over us. Digital photos, social media streams, financial and banking activity reports, wired and wireless sensors, GPS signals and a multitude of other sources can obtain this information. Today, about 12 terabytes of data is generated daily from tweets alone. The flow is quickening and shows no signs of decreasing; in just the last two years, almost 90 percent of the world's data has been generated today. "We are really facing a data flood, and by 2020 there will be 44 times more data available at the moment" (Manyika et al., 2011 as quoted by Gobble 2013). The introduction of emerging technology such as the Internet of Things plays an enormous role in the phenomenal development of the data we are seeing today.

The Ghanaian economy has recently seen a substantial boost in the rise of enterprises and organisations that capture growing volumes of digitized consumer and employee data. The oil and gas industry, the banking industry,

financial institutions (banks), the finance industry, government departments, retail stores and other data-driven firms are some of these sectors of the economy. In this report, along with the future effects of big data analytics, only a couple of these fields will be addressed. The growth in the country's mobile network operators means that many Ghanaians have connected to one or more of these telecommunications networks. Ghana should take advantage of the possibilities provided by big data that can be leveraged for its people and organisations to create a safer world.

Some of its services were launched online by the Government of Ghana in 2011. The online resources are made accessible via the web portal of the Government of Ghana. The web portal promises to act as a one-stop window for all the ministries, departments and agencies (MDA), MMDAs and other related Ghanaian government agencies providing services and information.

Four sub-portals, classified as people, non-citizens, enterprises and states, form the platform. This is a strong indicator that the government will receive significant organized and unstructured data (Ghana Government e-Services Platform, 2011). Since Ghana carries out these online services, it is likely that most of the data produced and collected can come from various devices and come in different formats (photos, images, text, audio, etc.). This makes the details unstructured.

In recent years, Ghana has seen a substantial change in most departments and ministries from paper-based to electronic record keeping. For example, the National Health Insurance Authority (NHIA) recently initiated the collection of biometric data for all clients under its scheme. Other organisations, such as

the National Identity Authority (NIA), the Electoral Commission (EC), the Ghana Education Service (GES), the Social Security and National Insurance Trust (SSNIT) and the Ghana Health Service (GHS), have switched from conventional data collection to the processing and collection of electronic data.

Suresh (2012) has suggested that one big problem is that their data is not exchanged by these organizations. Thus, while they generate and gather a lot of data, without being put to any use, these data remain in data warehouses. Users are unable to view this data remotely, and there are no computational methods for any useful information to be collected from it as they get access.

Policies to control the exchange and access of data from a shared forum within the public sector need to be put in place; the government may produce high demand for such data. Instead of searching for alternatives outside the world, it is important to improve computer science departments to have the research leadership necessary for its realization.

A sharp spike in the online purchases has also been seen in the financial services arena. For personal correspondence and also for financial and business transfers, including money transfer, work search, purchasing and sale of products, as well as for the transfer of data such as school grades, test results, stock levels and prices of different items, medical records, the use of mobile communication devices has become commonplace (Global Pulse, 2012). As banks build modern and open banking platforms and take banking services to previously unbanked regions of society, the implementation of new

technology helps accelerate a surge of disruption through the African financial services market.

Surash (2012) has suggested that there is compelling evidence in banking (and its related financial services) that industry has now accepted the ascendancy of data in the business domain. In a recent survey of over 600 global business leaders conducted by Capgemini and the Economist, three-quarters of business leaders accepted that their companies were data-driven, and 90 percent of them recognized knowledge as the fourth driver of development besides property, labour and capital (Gobble, 2013).

The banking sector in Ghana has changed from conventional walk-in and running transactions to an online and mobile banking venture where the customer's presence is not really required. In the last decade, the industry has grown significantly. The financial industry creates and holds vast volumes of consumer information. Banking industry figures show that banks in the Ghanaian markets spend up to 10 percent of their operating profits on data management, according to Suresh (2012).

In Ghana, Fidelity Bank, a mid-sized financial company that has developed over the last ten years to become one of Ghana's leading financial institutions, has invested in a robust Big Data solution, facing the difficulties of handling and protecting consumer data (Suresh, 2012). Another key consideration associated with the significant growth in data volume of financial institutions is risk in the form of fraud. Constant vigilance and deterrence through technology is the key to protection, and employing big data technology is a key measure to prevent attacks (Kothai, 2015).

2.10 Role of Big Data in Decision Making

Business leaders are confronted in the present period by high consumer demands, high competition, rising labour and commodity prices, and shorter product lifecycles. Globalization has blurred the lines between nations. Location and distance from the market are no longer obstacles to entering the marketplaces. In such a competitive climate, companies must constantly seek for obstacles and opportunities in order to make strategic decisions based on available facts. In this section, we discuss the role of traditional "small data" as well as "big data" in making business decisions.

2.10.1 Traditional decision support systems

Traditional decision support systems based on data provided by transaction processing systems like ERPs aid internal company choices (Davenport & Dyché, 2013). Further expansion has resulted in the incorporation of supply and demand-side complementary systems (SRM and CRM). These programs also aided to align the company's internal practices with its commercial partners, such as manufacturers (example Ariba) and consumers (example Siebel). In relational databases, both of these structures use well-defined structured data. From these decision support structures, internal organizational and logistical decisions were taken (such as how to market the goods for revenue optimization, order status investigation, inventory preparation, expense estimation, pending balance payments according to their due dates, etc.). Internal choices have become more precise and faster as a result of this data. Standard data sources provided inputs to the data warehouse and data mining processes. The overall design includes a main transaction database, as

well as a data warehouse that stores and categorizes extracted data into smaller databases. Additional data mining methods may be used to extract business insight from these databases. Data mining was used to evaluate and find patterns, correlations, and association rules in a large amount of data (Han et al., 2011).

2.10.2 Derivative of high veracity of data

Over the last few years, the knowledge needs of executives have evolved with the introduction of big data. There are broad datasets coming from different outlets of structured, semi-structured or unstructured ways, in addition to the conventional datasets mentioned above. There are many ways in which organizations can tap utility and make financial, tactical and organizational decisions from these datasets.

Market transaction data, when mined for alliance criteria, provides crucial information for making decisions about items purchased together or projecting demand for those products. Retailers like Wal-Mart may update their islands and group goods together to better identify trends, resulting in more sales (Shaw et al., 2001). Forecasting demand for such items aids in the preparedness for large-scale natural catastrophes including hurricanes (Shaw et al., 2001). The analysis of terabytes of data from aircraft engines yields signs of part failures, allowing for better maintenance and safety (Dyche, 2014).

2.10.3 Cost and time reduction

Big data uses various cost and time saving opportunities. Big data technology, such as Hadoop clusters, is developing as a significantly lower-cost alternative to traditional databases. It will play a part in real-time choices regarding advertising goods and services to consumers based on their current locations. UPS saves millions of dollars in fuel by receiving and analysing data from telematics sensors installed on its 46,000 cars and reconfiguring its vehicle routes utilizing this enormous information (Davenport & Dyché, 2013).

2.10.4 Optimization and simulations of supply chains

With numerous distributors and business partners, supply chains are becoming more dynamic. For the past two decades, supply chain participants have adopted business structures that monitor each transaction. The exchange of knowledge between business partners such as vendors and consumers exists with the promotion of EAI. In order to move items quickly through supply chains, technology is crucial. With inventory movement, scanning equipment such as sensors and RFID, position tracking devices such as GPS, video recordings, and so on churn huge quantities of data. Supply chain analytics improves decision-making skills by providing an integrated picture of data across the supply chain. We will extract, convert, analyse, and perform analytics to obtain insights from data sources inside the supply chain structure. Supply chain analytics provides several specific features, such as dashboards, pattern and trend analysis, drill down views, forecasts, knowledge base, scenario and what-if analysis, simulations, and optimization capabilities. These enhance decision-making abilities and situational interpretation, which is critical for businesses operating in changing market conditions (Nair, 2012).

2.10.5 Reporting and decision support

Many scholars, including Davenport (2012), have asserted that one of the key duties of management accountants is to provide information to top management.

Their earlier research indicated that, in addition to data processing and analysis, including empirical techniques into Big Data might help senior management make better decisions (Gandomi and Haider, 2014; Davenport, 2014; McAfee and Brynjolfsson, 2012; Markham et al., 2015; Warren et al., 2015; LaValle et al., 2011; Wrobel, 2012). Additional management accounting time can be made available due to the time-saving usage of Big Data in data collection, verification, and interpretation. Such studies' data analysis and action recommendations will subsequently become more important, perhaps leading to greater decision-making assistance for upper executives (Wimmes et al., 2015; Tretbar et al., 2013). For example, management accountants could progressively integrate unstructured market intelligence into their assessments. Unstructured data, which contains large amounts of non-financial data and accounts for around 80% to 90% of all accessible data (Gray and Alles, 2015), might therefore be utilized to gain a better knowledge of customer relationships, improve cost forecasting, and establish more exact prices (Bhimani and Willcocks, 2014).

Once it becomes increasingly difficult to create trustworthy forecasts using traditional methods owing to market uncertainty, Big Data offers more significant potential in the field of organizational planning and forecasting. Through Big Data applications and the increasing computational capability of

contemporary computer systems, a wide range of scenarios may be recreated in real-time from huge amounts of data.

Furthermore, new predictive forecasting methods, such as time-series analysis (Wimmes et al., 2015), will improve prediction accuracy. The enhanced clarity of Big Data will also aid strategic planning, since trends and risks can be discovered and assessed more quickly owing to the aforementioned predictive speed (Gänßlen and Losbichler, 2014;Vasarhelyi et al., 2015; Davenport, 2014).

Pattern and spectrum analyses may be done in real-time, and organizations can get more thorough insights into their ecosystems, allowing for better strategic and business decisions. Furthermore, real-time evidence may be used to verify findings, encouraging timely choices (Manyika et al., 2011). In exchange, data receivers, such as administrators, may utilize laptops, cellphones, or other electronic computers to show and demonstrate data in real time, regardless of their location (Gänßlen and Losbichler, 2014).

2.10.6 Predicting future outcomes

There are many ways to use datasets to forecast future results, according to Artun and Levin (2015). To evaluate various datasets and make forecasts, analytics frameworks may be developed as:

a) Using forecasting methods such as regression, based on past transactional evidence, forecast potential revenue for a company's goods or services.

b) It is important to classify goods bought together by consumers based on the similarities found in historical transactions.

A consumer's connection to these similarities and purchasing experience forecasts the goods a customer is most likely to purchase and make suggestions online (Artun & Levin, 2015).

2.11 Decision Making and the Role of Accountants in Decision Making

Decision usually refers to an opinion, mentality or choice gained after inquiry or appraisal. The judgment is a perceptual concept and the product of a dynamic mechanism of evaluation that takes into account the interpretation of important findings. Decision making is a mechanism that includes multiple tasks, such as awareness, appraisal, and then informs a concrete decision to assign a small range of resources for a person to accomplish a specific objective. Discovering facts, analyzing information, applying decision requirements and taking corresponding intervention are the core tasks of a decision-making process. Economic philosophy is the basis of decision theory since companies make choices dependent on logic and expediency to optimize advantages. The utility concept, on the other hand, was presented by the construction sector, and the experience became well-known and recognized as a major paradigm for conventional decision-making. The model, on the other hand, is ideal because the theory is referred to as idealistic since it relies on the planner's ability to define activities that may be followed to make decisions rather than the actual decision-making procedures. Decision-making is an important aspect of leadership as decision-making is included in the activities of all management including preparing, scheduling, hiring, delegating or controlling, managing, monitoring and budgeting. Decision-making is therefore the most significant role in administration.

Accountants and other intermediaries should play essential roles in the decision-making processes of data-driven decision-making in conjunction with their position in industry, which is to detect issues, consider alternative courses of action and report the outcomes of actions taken (Davenport, 2013; Waller & Fawcett, 2013).

Brand and Holtzblatt (2015 p.33) argue that "management accountants are positioned to play a key role in the implementation and application of business analytics in their organizations as they move beyond traditional, transaction-based accounting to analytics".

2.12 Opportunities with Big Data for Management Accounting

We handle Big Data for management accounting from these two viewpoints in three major phases, following our notions of both the problems and advantages of big data. The first two steps are

1) Generation and collection of data and
2) In accordance with our concept of Big Data, data collection, verification and analysis. Such data should ultimately be translated into usable information and in the sense of management accounting as described above, directed specifically at managers as information recipients. Accordingly, the third step in the following parts will be named as
3) Reporting and support for decisions.

2.12.1 Data generation and storage

Management accounting can be dramatically affected by the need to manage increasing volumes of data (LaValle et al., 2011). While many businesses produce vast volumes of real-time data, in most instances, those businesses base their decision-making on past-oriented and heavily aggregated data. It seems, though, that future-oriented or real-time data in management accounting will be increasingly important for management to make well-informed decisions (Wrobel, 2012; Manyika et al., 2011). This problem may be addressed by making judicious use of Big Data: Big Data, for example, is a synthesis, or rather integration, of existing, structured databases, such as data from relational databases; it is also feasible to make social media accessible using current, unstructured data (Bhimani and Willcocks, 2014). Thus, data collected from new knowledge streams, including social media or smartphone applications, may be employed in management accounting (Griesfelder, 2014; Gänßler and Losbichler, 2014; Wimmes et al., 2015). For instance, such data will help management accountants better understand and appreciate client connections, supplier ties, and labor relationships (Vasarhelyi et al., 2015; Gray and Alles, 2015). Furthermore, owing to machine learning, modern Big Data technologies can automatically gather such knowledge without the need for human assistance (Wang and Alexander, 2016; Chen and Zhang, 2014). When management accountants take advantage of this opportunity, senior management will get access to a new and extended level of competence thanks to this new data gathering approach (Bhimani and Willcocks, 2014). The ability to combine different data sources will result in cost savings as well (Davenport, 2014; Wrobel, 2012). Enterprises will increasingly employ more

cost-effective technologies, such as cloud computing, to outsource less important data gathering to remote servers, meaning that not all data must be processed in company-owned computer centers using Big Data. However, data outsourcing may provide new or additional risks to management accounting. For example, there may be concerns about data security or the eventual termination of service contracts with particular cloud providers. As a result, abovementioned prospects must be implemented with extreme caution (Gärtner and Rockenschaub, 2015; Bhimani and Willcocks, 2014).

2.12.2 Data processing, verification and analysis

The availability of real-time data is one of the most valuable resources given by Big Data (e.g., Hashem et al., 2015; Bhimani and Willcocks, 2014; Manyika et al., 2011; Hurwitz et al., 2013; Vasarhelyi et al., 2015; Krahel and Titera, 2015; Wrobel, 2012). Recent advances, for example, mean that real-time data may be utilized in management accounting to gather data from RFID, GPS, internet applications, and sensors (Gänßlen and Losbichler, 2014). Big data processing is easier and perhaps safer than traditional data analysis methods, and it may ideally "provide the appropriate insights, based on the right data at the right time" (Hurwitz et al., 2013). Big data processing isn't limited to huge corporations with distinct IT departments and plenty of resources. Small and medium-sized businesses can also benefit from reasonably cost analytical tools (Kristandl et al., 2015; Bartram, 2013). There are few restrictions on how big data may be used in appropriate business areas, albeit some will benefit more than others. The utilization of up-to-date, real-time data appears to be extremely efficient in customer- or service-oriented

industries, such as financial or IT services (Wimmes et al., 2015; Davenport, 2014).

As per Davenport (2014), Big Data technology will result in time savings in data processing and analysis. He's implying that the existence of real-time data allows for speedier interpretation and timing with the click of a mouse. Detailed testing, which usually take only a few minutes, take less time. Thus, they would add to competitive advantage.

Customers and marketplaces may be segmented more simply and efficiently with Big Data processing. Products and services, for example, should be suitably customized to market preferences (Manyika et al., 2011), including the personalization of contacts with prospective customers (Provost and Fawcett, 2013). Each customer may thus be provided a service or gadget that is specifically tailored to him or her, as well as a package that can be modified in real time based on his or her preferences (Gandomi and Haider, 2015). In this respect, it seems especially beneficial to use in-memory applications where testing is carried out exclusively in the working memory, thus ensuring fast processing (Davenport, 2014; Chen and Zhang, 2014; Gänßlen and Losbichler, 2014). Subsequently, management accountants can have better decision support through real-time processing of results. A additional difficulty for management accounting is the digitization of data processing and analyzing, which may be both an advantage and a disadvantage at the same time, as will be discussed more below.

2.12.3 Reporting and decision support

As previously said, one of the major tasks of management accountants is to provide data to senior management. Previous study suggests that, in addition to data processing and data analysis, the integration of computational techniques through Big Data would contribute to enhanced decision support for top management, as indicated by Davenport (2014). More management-accounting time can be made available as a result of the time-saving usage of Big Data in data collection, authentication, and interpretation. Such studies' data analysis and action recommendations will subsequently become more important, perhaps leading to greater decision-making assistance for top management (Tretbar et al., 2013; Wimmes et al., 2015). For example, management accountants may gradually include unstructured consumer knowledge into their assessments. Unstructured data, which contains huge amounts of non-financial data and accounts for around 80% to 90% of all available data (Gray and Alles, 2015), might therefore be utilized to gain a better knowledge of consumer interactions, improve cost forecasting, and set more exact pricing points (Bhimani and Willcocks, 2014).

As it becomes increasingly difficult to create trustworthy forecasts using traditional methods owing to market uncertainty, Big Data offers more significant potential in the field of organizational planning and forecasting. Through Big Data applications and the increasing computational capability of contemporary computer systems, a wide range of scenarios may be recreated in real-time from huge amounts of data.

Furthermore, new predictive forecasting methods, including time-series analysis (Wimmes et al., 2015), will improve prediction accuracy. The

enhanced clarity of Big Data will also aid strategic planning, since trends and risks can be discovered and assessed more quickly owing to the aforementioned predictive speed (Gänßlen and Losbichler, 2014; Davenport, 2014; Vasarhelyi et al., 2015).

Pattern and spectrum analyses may be done in real-time, and organizations can get more thorough insights into their ecosystems, allowing for better strategic and business decisions. Furthermore, real-time evidence may be used to verify findings, encouraging timely choices (Manyika et al., 2011). In exchange, data receivers, including administrators, may show and demonstrate data in real time using laptops, cellphones, or other mobile devices, independent of their location (Gänßlen and Losbichler, 2014).

2.13 Business Intelligence and Big Data

In the 1990s, the term "business intelligence" became prominent in IT and business literature. It's been used to describe data gathering and interpretation techniques, as well as software for decision-making (Chen et al., 2012). In the 2000s, business analytics was defined as "the use of data, statistical analysis, information technology, quantitative methodologies, and mathematical or computer-based models to assist managers in gaining a better understanding of their operations and making better, fact-based choices" (Davenport & Harris, 2007). Business intelligence and analytics are provided through data management tools and market-centered methodologies used in many high-impact applications such as e-commerce, e-government, healthcare, and military (Chen et al., 2012). For some organizations, using big data to identify shifting trends and prosper in the business climate has become a need. The increasing popularity of the internet since the early 2000s has

allowed search engines and e-commerce companies to collect particular data and connect with their customers on a personal level. Unstructured data is transformed into usable commercial decision-making information via online analytics, user-generated social media material, and crowd-sourcing platforms. Smart phones, laptops, and other Internet-connected sensor-based devices with radio frequency identification and barcodes are creating opportunities. Location-aware and person-centered operations and transactions are expected to open up new prospects in the domains of accounting, communications, logistics, and operations management (2012: Chen et al.).

Due to fast-paced technological progress, as well as diverse data formats and speeds, there is no clear definition for what constitutes big data (Gandomi & Haidar, 2015).

Every second, more data being transmitted via the internet than was processed on the internet as a whole 20 years ago (McAfee & Brynjolfsson, 2012). Data that is massive today will be trivial in the future. Companies may now work with a single collection of data containing many petabytes. Walmart, for example, collects more than 2.5 petabytes of data each hour from customer purchases, while Facebook keeps more than 260 billion photos over 20 petabytes of storage space (Gandomi & Haidar, 2015).

Data flow velocity is the most important aspect in big data for numerous organizations (McAfee & Brynjolfsson, 2012). Micro-cameras, precision sensors, and radio frequency recognition tags are examples of real-time data collecting technology (Bhimani & Willcocks, 2014). The desire for real-time analytics has accelerated data flows (Gandomi & Haidar, 2015). Goods and

procedures will acquire and interpret information on the spot without the need for independent information systems (Bhimani & Willcocks, 2014). Businesses have basically anticipated customer purchases before they are recorded using cellphone location data in shopping center parking lots, for example (McAfee & Brynjolfsson, 2012).

In addition to the three Vs already mentioned, other elements of big data have been discussed in the literature. The validity of big data is reflected in the unpredictability of knowledge acquired. Working with ambiguous and inaccurate outcomes is a constant in the development of sophisticated analytics tools. The patterns of data flow are typically irregular, with occasional peaks and troughs. Information heterogeneity is the term used to describe this phenomenon. Ultimately, the sixth V is a number that represents the data's low value density in relation to its vast volume in its original form (2015 by Gandomi & Haidar).

For some organizations, using big data to identify shifting trends and prosper in the business climate has become a need. New data forms will reveal new items and sales methods, as well as create entry hurdles for new market entrants. eBay, for example, modifies its listings depending on prior listing behavior, bidding trends, price changes, search keywords used, and purchase frequency. Likewise, Google's search results are based on what previous users found useful. Data analytics must be used in order for management to have access to both structured and unstructured industry patterns and knowledge of consumer behavior (Bhimani & Willcocks, 2014).

According to Chui, Loffler, and Roberts (2010), the Internet of Things is transforming the actual world into a knowledge environment in which data can be acquired, exchanged, and processed by linked physical objects such as computers, automobiles, and buildings. This digital network of artifacts will generate large data that can be used by predictive algorithms to improve efficiency and reduce both development and distribution costs. Cloud computing, which is based on the internet, has allowed businesses to save money while storing and distributing data (Bhimani & Willcocks, 2014). Organizations may now deliver accounting data in innovative ways by outsourcing software via the internet.

In addition to the change from historical data to real-time analysis, big data pulls analytics away from the usage of surveys. With advanced analytics software, it is possible to evaluate whole collections of data at once and to render wider questions about the data. Interrelationships between data sourced internally and externally that were not historically available are now clear. The capability to leverage real-time insights on massive data sets provides companies with valuable opportunities (Bhimani & Willcocks, 2014).

According to a research conducted by Accenture in 2014, Finland will see a big data breakthrough in the next three years. Over half of respondents in the communications, media, retail, and computer manufacturing industries believe that big data is already present in their industry. According to Finland's Ministry of Transport and Communications (Liikenne- ja viestintäministeriö, 2013), big data may boost the country's GDP by 2.1 percent by 2020. Big data utilization, on the other hand, has been found to be in its infancy, with businesses still looking for ways to add value to it.

2.14 Challenges of Big Data

According to a 2017 study by the Chartered Global Management Accountants, the fast rise of the evidence that businesses now have at their disposal adds to a commensurate development of the types of insights that may be acquired utilizing various analytics approaches. Data processing is required in a variety of ways, from simple reporting to predictive analytics. Furthermore, when new resources are developed, the number of possible options continues to grow. Consultancy firms now provide analytics services in areas such as operational resources, customers, communications, Human Resource, predictive asset maintenance, business outcomes, fraud detection, advanced forecasting, and risk analysis, to name a few.

Companies should start by establishing the primary market issues they intend to solve, taking into account the vast range of options. For example, a firm must first understand its business strategy and intangible assets, as well as its data systems, data consistency, and data sources, before diving into the realm of unstructured data processing. According to Joe Peppard, a professor at the European School of Management and Technology in Berlin, organizations may utilize data in two ways: to aid decision-making and to find new information. Usually, while looking for fresh information, you start by asking data queries, primarily to uncover the unknowns. As a result, both the investigative method and the evidence employed must be consistent.

Companies can leverage previously produced dashboards and reports to assist them in making additional choices. Typically, they are created utilizing business intelligence tools and report writers.

For others, the investigation of information determines if a decision is required. Organizations must identify the information needed to answer their questions after the problem they are attempting to solve is discovered. Getting the data together in a usable format is a significant problem in and of itself. The most common weak spot, as per Global Management Accountants (2017), is operational silos that prevent data aggregation.

One issue is data consistency, with almost half of financial professionals identifying faults in their organizations. Furthermore, nearly two-thirds of respondents said that data accuracy and durability needed to be significantly enhanced in order to better support decision-making or performance management. Nevertheless, because accountants may exaggerate the importance of data correctness, it's critical to strike the proper balance, especially given how critical data accuracy is for regulatory reporting. Finding patterns or correlations in data exploration, on the other hand, may be more important than 100% correctness in determining whether something is directionally accurate.

Data security, and the norms of governance that management accountants must apply to this essential and frequently sensitive subject, is a related problem. This is a crucial issue in and of itself, outside the scope of this study, but it is apparent that as accountants in management go more into the digital environment, they must be aware of the difficulties and ethics involved in the processing of sensitive information. To enjoy the benefits of a company's investment in big data technologies, Jaroslaw Chrupek, Global Data Manager at British American Tobacco (BAT), says it's critical to guarantee that robust data systems and regulatory processes are currently in place: "When compared

to investing a comparable amount on establishing a solid informal infrastructure, a big data analytics investment can be significant."

2.14.1 Data generation and storage

In addition to the benefits considered above, there are also certain risks and corresponding difficulties inherent in the implementation of big data. In this regard, the key problem always concerns the sum of potential data. Huge, even seemingly infinite volumes of data are accessible today, but major challenges are posed by the collection of data samples, data filtering and the resulting profitable use of data (Tan et al., 2015). "When the challenge of defining specific data from an almost endless number of data is met by management accountants, working with big data will contribute to "knowledge overload"" (Schick et al., 1990; Eppler and Mengis, 2004). Information overload typically occurs from a "combination of more information and limited capacity to process information" (Schick et al., 1990, p. 199) and seems to be extremely possible in the implementation of Big Data technology, as data is always accessible in real-time and vast quantities of additional data are continually produced. To prevent information overload, management accountants must pay close attention to data quality and choose only the highest-quality data for subsequent processing (Bhimani and Willcocks, 2014). Undirected processing of large amounts of data, on the other hand, may result in faster decisions, but it is not dependent on the data that is best for the situation. As a result, Quattrone (2016, p. 120) is concerned that "people make bad judgments more faster than previously" because of Big Data technologies.

The requirement to encourage sufficient validity of sensitive data is inextricably linked to the broader problem of knowledge overload, which is a fundamental component of the Big Data idea discussed above (Brands, 2014; Gandomi and Haider, 2015; Hashem et al., 2014). As a result, Hazen et al. (2014) emphasize that ensuring the rationality, accuracy, timeliness, completeness, and format of the data utilized is a critical challenge in the usage of Big Data. In addition to these difficulties, there is also the issue that, like in many other fields, the use of big data in management accounting is frequently hampered by a lack of qualified personnel (Davenport, 2014).

This overall shortage of qualified workers may also explain why many businesses lack specialists who can convincingly communicate the benefits of Big Data to upper management. This paucity of big data experts, in particular, may explain why many senior executives have yet to adopt big data technologies. In other words, the absence of top-level support for Big Data in accounting for management might be regarded as yet another roadblock, one that could lead to further resistance from other employees. This lack of top-level support can also lead to an excessively long-term adoption of Big Data technologies, particularly when choices aren't made in real time or delegated properly (King, 2013). As a result, management accountants may need to lobby for increased Big Data understanding among managers and other potential Big Data consumers. As a result, in the context of Big Data, administrators should be free of the need to utilize traditional data-handling methods, which is a typical reason why Big Data implementations fail in practice (Jacobs, 2009; Provost and Fawcett, 2013).

2.15 Challenges in Implementing Big Data in Ghana

There are several problems facing Big Data as a system in use, one of which is heterogeneity and incompleteness. The efficient representation, access and analysis of unstructured or semi-structured data creates analytical and storage problems, because computer systems work more successfully if they can store several objects that are all similar in size and form. The number of data to be focused on inside an enterprise is another problem. The handling of huge and rapidly growing data volumes can be difficult and involves the design and installation of faster computing components and storage systems. Speed may also be a challenge to deal with as massive data sets have to be processed.

This is because the bigger the data collection to be analyzed, the longer the analysis will take. Privacy is another obstacle. For example, with electronic health reports, there are specific rules regulating what can and cannot be done. Big data poses questions and concerns about the unauthorized use of personal data, especially by multi-source data linking.

Apart from those discussed above, the application of Big Data in Ghana has its own problems. Big Data has a great deal of growth opportunities. Global Pulse (2013) has described Big Data for growth to mean the identification of big data sources related to development program policy and planning. This idea is separate from both the idea of traditional data creation and what the private sector and mass media refer to as Big Data.

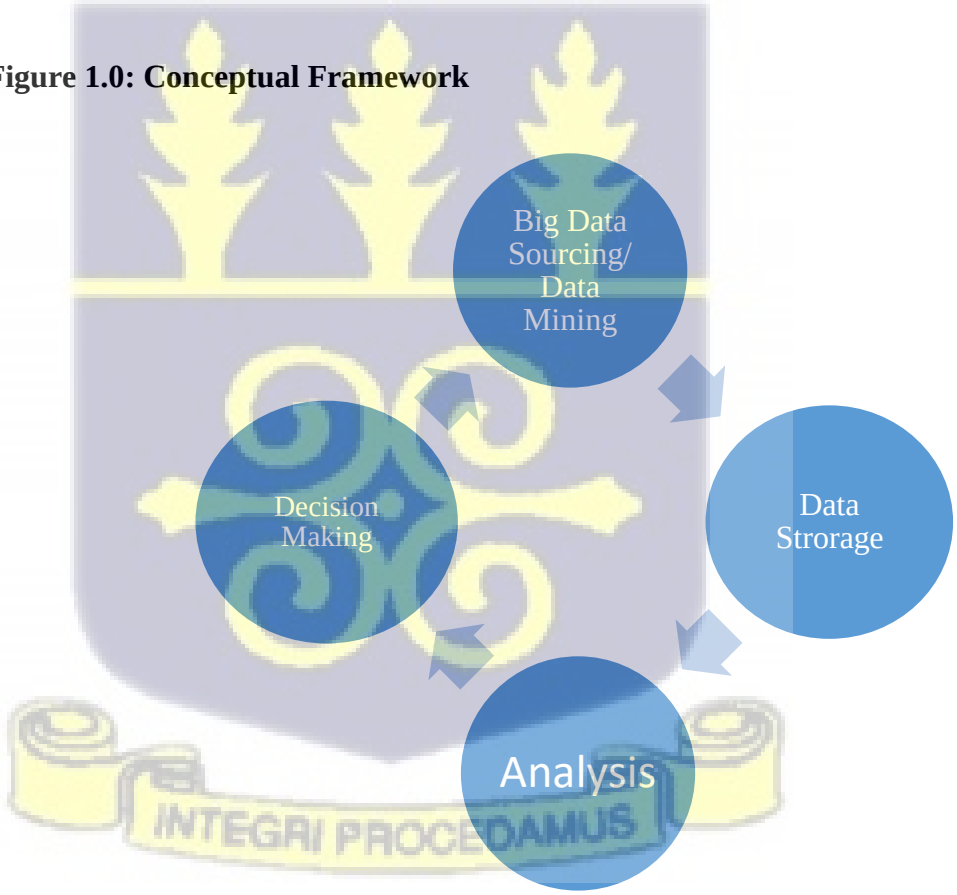
The shortage of infrastructural resources and the required infrastructure also presents a threat to Ghana's Big Data implementation. The unavailability of professional workers with the expertise and qualifications involved with big data analytics is another obstacle. In 2013, the Commonwealth of Australia

indicated that because there is a lack of university degrees with a Big Data Analytics program, it is important for education providers to develop courses targeted at education and training in the field of Big Data scientists.

2.16 Conceptual Framework

Conceptual framework stipulates a model designated to guide a study based on the variables and objectives outlined by the study. In the conduct of this study, some variables (data, analytics and decision making) as already established by other literature are used to guide the study in making inferences and further analysis in subsequent chapter of this report. The conceptual framework is outlined in Figure 1.0 below

Figure 1.0: Conceptual Framework



Source: Author's Construct, 2020

As illustrated in Figure 1.0, big data management and decision-making trend in accountancy is often regarded as being cyclical. That is at the initial stage, accountants focus on gathering prerequisite data from clients and customers from various data sources (internet, credit card and other sources) and then stores such data for future use. The process transcends further to analysis, where big data is queried for either statistics, diagnostic, predictive or prescriptive purposes. After thorough analysis is run, data managers and accountants use the data generated to make accurate and informed decisions for firms. However, the decisions are further used as raw data for further inferences to be made. In subsequent chapters, this study correlates the various elements and processes illustrated in this framework.

2.17 Reflections on the Literature

The literature on Western societies has revealed that decision making in business entities are not instinct-driven but rather a scientific procedure that calls for the application of statistical and analytical facts, figures and projections by accountants. Due to the heterogeneous nature of technology, data and skills in most contexts of Africa, the attempts by several multinational companies in making various strategic, managerial and financial regulatory decisions on the basis of available data, technology and skills is greatly challenged. This calls for the exploration of various means by which multinational firms could optimize the reliability, quality and time-efficiency of decisions at cost-effective levels to ensure the successful thrive of their various operations. The literature revealed that there is a strong positive correlation between big data management and decision making; that is, the

higher the extent to which accountants are able to manage data effectively, the higher the probability of attaining the quality of decisions made out of such dataset. While big data is hastily becoming eminent in decision making by most accountants, there are tensions that arise as a result of inadequate expertise in its management and application.

2.18 Theoretical Perspective

This study was grounded on theories including Adam Smith's Agency Theory of management, Decisions theory of management and the Database Design theory developed by Edgar Frank Codd in 1970. This is due to the prevalent use of such theories by other scholars in analysing problems and themes pertinent to big data and decision making. The theories are further explained based on its relationship with this study in the subsequent section.

2.18.1 Agency Theory of Management

The agency model is one of the first theories in management and economics literature (Wasserman, 2006; Daily, Dalton, & Rajagopalan, 2003). The agency theory examines the issues that arise in businesses as a result of the separation of owners and managers, with a focus on how to address them. This idea, according to researchers who have dealt with comparable issues, aids in the implementation of various governance systems to regulate the agents' actions in jointly held businesses. Berle and Means (1932) discovered that the contemporary company in the United States has dispersed ownership, which results in the separation of ownership and control. The ownership of a joint stock company is held in the form of stock by individuals or groups, and the shareholders (principals) delegate authority to the managers (agents) to

manage the business and make management decisions for the group (Jensen & Meckling, 1976; Ross, 1973), but the main question is whether these managers are working for the owners or for themselves (Jensen & Meckling, 1976; Ross, 1973). Adam Smith (1937) is said to be the first to detect the existence of an agency issue, and it has been a driving force for economists to advocate parts of agency theory ever since. In his book "The Wealth of Nations," Smith predicted that if an organization is controlled by a group of individuals who are not the true owners, they may not operate for the advantage of the owners. Berle and Means (1932) furthered this worry in their study of the ownership structure of big American corporations, finding that agents selected by the owners manage large corporations and conduct commercial activities. They claimed that the agents may utilize the firm's property for personal gain, resulting in a dispute between the founders and the agents. In the 1960s and 1970s, the financial literature defined the agency problem in organizations as a problem of risk-sharing among the collaborating parties (Arrow, 1971; Wilson, 1968) participating in the organizations. Individuals and organizations in the company have varying risk tolerances, and their behaviors reflect this. The principals, or owners, spend their capital and incur risks in order to get economic advantages, whereas agents are in charge of the firm's management and are risk averse and concerned with maximizing their private gains. Both the principal and the agent have opposing risk preferences, and their inability to share risk leads to agency conflict, which is extensively defined by the agency theory. In their separate writings, Ross (1973) and Mitnick (1975) developed the idea of agency and proposed two alternative methods. Although Ross saw the agency problem as a matter of incentives and Mitnick saw it as a

problem of institutional structure, the basic premise underpinning both ideas is identical. Ross established the principal–agent dilemma as a result of the compensation choice, and he asserted that the problem is not limited to the company; it also exists in society. Mitnick's institutional approach aided in the development of the fundamental agency theory's logics, and it was probably created to comprehend real-world behavior. According to Mitnick's thesis, institutions are formed around agency and expand to reconcile with it. A firm is described as a "series of contracts between the components of production" by Alchian and Demsetz (1972) and Jensen and Meckling (1976, page 108). Organizations, they said, are legal fictions in which some contractual ties exist among the individuals participating in the business. The agency relationship is a type of contract between the principal and the agent, in which both parties work for their own benefit, resulting in agency conflict. In this setting, principals engage in a variety of monitoring activities in order to limit the actions of agents and maintain agency control. The incentive structure, labor market, and information asymmetry all play important roles in the principal–agent contract, and these factors contributed to the development of the ownership structure theory. Jensen and Meckling (1976) depicted the corporation as a black box that seeks to maximize its worth and profits. The maximization of wealth may be accomplished by effective coordination and collaboration among the stakeholders engaged in the business. Nevertheless, when the parties' interests diverge, a conflict of interest develops, which can only be resolved by management ownership and control. The self-interested parties also understood that their interests could only be met if the company existed. As a result, they contribute to the company's existence. Fama (1980)

argued that businesses may be disciplined by competition from other players, who examine the functioning of the overall team as well as individual employees. Fama and Jensen (1983) studied the decision-making procedure and residual claims. They divided the firm's decision-making process into two categories: decision management and decision control, with agents playing a major role in both. Decision management and decision control are the same in non-complex businesses, yet both exist in complex firms. The agency problem emerges in the management decision-making process in those complex businesses because the decision-makers who start and implement the firm's decisions are not the true carriers of the wealth consequences of their choices. They concluded that these agency issues must be managed in order for the company to survive. Grossman and Hart (1983) told an intriguing story of the principal's and agents' risk preferences diverging. They emphasized that the agent's production influences the principal's consumption. The degree of effort put forth by agents has an impact on the production of the company, with the principals desiring a higher level of effort from agents. As a result, the principal should trade-off the agent's behavior with an appropriate payment structure, which they determined using an algorithmic model. The incentive structure is influenced by the agents' attitude toward risk and the quality of knowledge held by the principals, and there is no incentive problem if the agent is risk averse. Eisenhardt (1989), the positivist agency model and the principal–agent model (Harris & Raviv, 1978), divided the agency theory into two versions. Both of these models are based on the principal–agent contractual relationship, although the principal–agent model is more mathematical. Principals are risk averse and profit seekers, whereas agents are

risk averse and rent seekers, according to the principal–agent paradigm. The origins of agency problems and the costs associated with them are explained by positive agency theory. Two assertions are proposed by this theory. The first proposition states that if the contract's result is based on incentives, the agents will behave in the principal's favor. Second, if the principle has knowledge of the agents' actions, the agents' actions will be penalized.

Perrow (1986) critiqued positivist agency scholars for focusing solely on the agent side of the 'principal and agent issue,' claiming that the issue may also occur on the principal side. He pointed out that the principals, who lie, shirk, and abuse the agents, are unconcerned under this view. He further stated that the agents are inadvertently forced into employment in a dangerous atmosphere with little room for incursion, where principals behave as opportunistic. In another manner, he thought that humans are honorable and labor morally for the benefit of the company. This argument continued in the financial literature, and stewardship theory emerged as a popular idea (Donaldson, 1990). Despite the fact that agency theory is highly practical and popular, it nevertheless has a number of flaws, as Shleifer and Vishny (1997), Eisenhardt (1989), and Daily et al. (2003) have demonstrated. The idea is based on a contractual agreement between the principal and agent for a finite or indefinite future time, where the future is unknown. Contracting is supposed to solve the agency problem, however it has a lot of drawbacks in practice, such as knowledge asymmetry, rationality, fraud, and transaction costs. Shareholders' primary goal in the company is to maximize their profit, yet their participation in the company is restricted. Directors' responsibilities are

restricted to overseeing managers, and their other responsibilities are unclear. The idea believes managers to be opportunistic and disregards their skill.

The term "big data management" refers to the process of organizing, administering, and governing massive amounts of data that may be either organized or unstructured. The purpose of big data management is to guarantee a high degree of data quality while also making it easily accessible for use in applications such as business intelligence and big data analytics. Because of the vast number of data that has to be managed, big data often requires most businesses to include a third party as an agent for its administration. Therefore, the application agency theory is quite important to consider when carrying out this research.

2.18.2 Decisions theory of management

The Decision Theory of management as propounded by Herbart Simon considers management process as a decision-making process. Herbart (1947) pointed out that decisions are made through rational choice among different alternatives available. Literature in developed worlds suggest that whatever a manager does, he does through making decisions. Hence, decision making is central to managing. Simon developed the administrative model of decision making which describes how various decisions sprouting from managerial, strategic, operational and financial regulatory decisions are actually made. In almost all business entities, managers are often faced with uncertainty and non-programmed decision-making situations. Simon's decision model is based on two concepts: (1) bounded rationality and (2) satisficing. On the basis of these, Herbart (1947) outlined key steps expected of all managers in order to make time-efficient and accurate decisions. These prerequisite steps include:

i. Recognize and define the decision situation

ii. Identify appropriate alternatives

iii. Evaluate each alternative

iv. Select the best alternative

v. Implement the alternative, and

vi. Evaluate the results and follow up.

Before taking any decision, the manager should know and understand the situations that will be created after taking the decision. The manager should also identify the alternative solution of decision that may help the manager in the future. The decision theory helps to find out alternative solutions of the problems. Scholars such as Haley (1979) have ascribed several merits associated with the use of the decisions theory of management in world-class businesses in developed countries. Some of these include:

- The theory involves a better selective process, it gives the best possible alternative.
- The theory calculates risk and analysis all the possible alternatives.
- Decision-making is a continuous process which runs until the organizations run.
- This theory improves the efficiency of the manager.

In relation to the study and the application of decision theory, it is safe to assume that the effect on decision-making was greater the further along the organizations were in their work with analyzing and disseminating big data analytics. This is a reasonable assumption given the findings of the study and the application of decision theory. It was discovered that the process of

making decisions is getting more open, accurate, efficient, and even, to some extent, quicker.

2.18.3 Database design theory

The general objective of database design theory, as per Codd (1970), is to capture as much of our model's structure as feasible, especially the restrictions in the database schema itself. As a result, the database engine can automatically enforce certain restrictions, which streamlines the application logic built on top of it. The advantages of a "normalized" database structure are twofold:

- Minimal redundancy: Although we discussed redundancy in the E/R model, database design theory provides a formal method for identifying and eliminating redundant data in database architecture.
- Constraint capture: The structure of a relational model may describe some sorts of constraints implicitly, which we will use to simplify the application of enforcing them.

The capacity to produce meaningful information by connecting various forms, classifications, and structures of datasets is the fundamental advantage of the relational database method. As employed in this theory, further processing of large data results in the creation of considerably more valuable, meaningful, and well-organized data for decision-making. This theory has served as the foundation for several decision-making models and theories, including Herbart's (1947) Decisions Theory of Management and other similar ideas, in current analytics and decision-making. Although Codd's Database Design Theory may be seen as a pure informatics systems theory, it is also important to highlight its significance to the effective sourcing, storage, and

administration of large data, as well as its application to decision-making in companies and modern industries.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the processes that were employed for conducting the research. The research paradigm research design, sampling methods, instruments for data collection, data analysis, ethical consideration and limitations of the study are all discussed. The reasons that accounted for the choice of the techniques, the methods and participants have also been explained.

3.2 Research Design

The design of analysis includes the strategy or pattern allocated for the conduct of a study while taking into account the problem's scale, subjectivity and emphasis (Strydom, Fouche, and Delport, 2005). These writers suggested that the design of the research is a strategy or blueprint of how the research is planned to be carried out. A research design focuses on the final result, formulates an issue of research and focuses on research logic. In the conduct of this report, however the investigator found it necessary to use the research design of the case study. Neuman (2007) reveals that case study architecture examines in detail various highlights or measures of a structure period or multiple frameworks over a period of time through the use of several approaches to capture in-depth analysis knowledge. The researcher felt it necessary to use the case study design to study selected companies in the needed specifics for further analysis and inferences due to the subjectivity of issues relevant to the advent of big data in multinational firms in Ghana. On the other hand, the qualitative analysis technique for its behavior was used in

this review. As it enables the use of triangulation (of data collection techniques and data sources) to thoroughly analyze the expectations, management and use of big data in decision making by accountants in global companies in Ghana, the qualitative case study methodology has been used. The qualitative analysis helped the researcher to consider the individuals and the social environment under study. It also allowed the people being studied to elicit and explain their values, dispositions and feelings through actions, gestures and words which are necessary in the conduct of this study.

3.3 Study Area

This study was conducted in the Accra Metropolis in the Greater Accra region of Ghana. Accra is noted as the densely populated and the second most industrious city in Ghana but first in the region with a population of about 2,052,341. The Accra metropolis has ten districts and municipalities in its hub while serving as the central business district for all as well as the entire country. Accra is the center for manufacturing, marketing, insurance and banking institutions which is evidenced from the availability of about 4,054 industrial and commercial properties. Accra serves as the headquarters for most accounting companies in various sectors of the economy such as banking institutions, telecommunication companies, real estate agencies as well as the Institute of Chattered Accounting, Ghana.

The Accra metropolis was used for the conduct of this study due to the greater accumulation of diverse multinational companies (service, manufacturing and primary industries) in its hub. For this reason, it facilitated easy access to

diverse information and target respondents pertinent to big data and decision in Ghana.

3.4 Target Population

The target demography includes the total number of people, organisations or communities that are identified as the population to be analyzed (Guest et al., 2013). The authors further explained that the target demography of a study is the prescribed category of targeted individuals viewed by the researcher as bearers of knowledge (with greater perspective and information on the subject under study) and thus necessary for the study to be performed. For data collection, it is from this category that the unique and real number of respondents is delineated. Thus, for this research, the target group included accountants in Ghana's global corporations who use big data to make decisions with at least two years of working experience. This population is selected because they have access to big data and possess comparative changing trends in big data sourcing, management and utilization in the accounting sector; hence being in better position to give detailed and practical accounts of how they manage, analyse and utilize big data in various aspects of decision making in accountancy.

3.5 Sample Size

The Information Power Principle as developed by Malterud, Siersma & Guassora (2016) stipulates in the conduct of a solely qualitative analysis that it is necessary to survey limited but sufficient number of respondents with in-depth knowledge of the data collection issue under study. Twelve (12) respondents have been polled in this respect (selected from the target

population). This number was chosen by the researcher on the basis of explicitly defined parameters such as the availability of services, the right representation of sub-groups and the factors of location.

3.6 Sampling Procedure

Sampling means choosing a few suitable people to represent a community or region's general population. The usage of a qualitative analysis method calls for the use of non-probability sampling methods, as demonstrated by Patton (2002). Participants were grouped into sub-groups at the initial stage of this analysis, such as accountants in multinational telecommunications firms, accountants in multinational banks, accountants in multinational brand distribution companies (including cars) and others after which non-proportional sampling (including purposeful sampling) was used. The investigator complemented the sampling protocol with the stratified sampling technique. At this stage, the few accountants (respondents) identified earlier assisted in the identification of other accountants in similar multinational companies. In tentative terms, Table 3.0 below illustrates the representation and sampling procedure for this study.

Table 3.0: Sample Representation of the Study

Sample Frame of Respondents	Number of Respondents
Telecommunication firms (Airtel-Tigo)	2 respondents
Banks (Stanbic, Standard Chartered and Zenith)	1 from each agency (3 in all)
Brand distribution companies (Toyota Ghana Ltd)	2 respondents

Multinational mining company (Anglo-Gold Company Ltd)	2 respondents
Others (Nestle Ghana, Mondanese and Adesco Int.)	1 from each agency (3 in all)
Total	12

The researcher deemed it appropriate to use the purposive and stratified sampling technique respectively in order to ensure adequate representation of accountants in various sectors or branches of the economy as represented in multinational companies. Moreover, the use of purposive and stratified sampling technique guided the researcher against unnecessary wandering for information but facilitated eliciting first–hand data from experienced accountants who source, manage and utilize big data in decision making.

3.7 Data Sources

For the purpose of this study, the researcher used primary data elicited from respondents in the study area. The researcher preferred the use of primary data due to its genuineness and devoid of alterations and modifications, and which has a greater propensity to generate adequate and reliable findings. The use of secondary data was less preferred for the study due to its relative scanty existence in the Ghanaian context as well as the obsolete state of the few which renders such secondary data unsuitable and inappropriate for the conduct of the study. It is on this assumption that secondary data was not involved in this study.

3.8 Data Collection Procedure

Data (first–hand) information for this study was elicited from accountants (sampled respondents) through interactive and face-to-face personal interview sessions.

In this regard, interview sessions were booked during the pre-test stage of the study while issues relating to research ethical considerations were outlined and checked appropriately. The researcher approached respondents in the usual workplaces where break sessions were scheduled for the interview sessions. The rationale behind this was to enable the researcher to observe (when necessary and appropriate) key issues and practices that may be pertinent to the study. During each interview session, audio recorders were made available in order to record audio speeches and clarifications made by respondents. Moreover, noticeable observations made by the researcher were recorded in the field notebook in the course of the data collection. The medium of communication (dominant language) in the interview sessions was English since all respondents could speak as well as understand the English language.

Substantially, questions were asked sequentially on the basis of the outlined research objectives and themes of the study. On the fateful grounds, each interview session was perceived to last for about forty–five minutes but however, the brief hesitation and further clarification of facts, experiences and sensitive issues led to varying time span of the interview sessions. In similar regard, the data collection process was envisaged to take about three days but issues such as reschedule of appointments and distance led to the completion of the data collection in about five days.

3.9 Instrument for Data Collection

The data collection was assisted in the conduct of this research by an in-depth interview guide (IDI). This was based on Van den Hoonaard's (2012) statement that an in-depth interview guide guides the researcher to explore the study's topical areas while allowing respondents the ability to provide thorough explanations and clarifications. The IDI used in this study invariably included objects ordered by the researcher sequentially and thematically; igniting the curiosity of respondents in presenting answers that produced follow-up questions that were acceptable and important to this study (although several of these main issues were not expected by the researcher). The interview guide was written in English language with about twelve items (questions) which reflected the outlined study objectives devoid of ambiguity and sensitive issues that could be repulsive to respondents in their pursuit to responding to questions. The structural organization of the in-depth interview guide used in this study was in such a way that, there was the title of the instrument as well as the title of the study. Moreover, there was a brief statement of the introduction (overview and purpose of the study as well as the consent for participation). A section was provided for the statement of brief personal details of the researcher (enumerator) while other thematic sections specifically focused on the outlined research objectives.

3.10 Techniques for Data Management and Analysis

In order to contribute to the validity and reliability of our analysis, Rabiee (2004) suggests that it is a necessity to ensure the confidential and proper handling (storage of data. In this research, however, information gathered from respondents through interviews was further transcribed verbatim).

Moreover, to form part of the verbal extracts elicited from the respondents, scanty findings reported in the field notebook were further transcribed. Interview transcripts were then stored on Google Drive and hard drives to ensure reliable data processing and retrieval, in order to avoid the loss of information vital to the analysis.

Transcripts were consequently arranged as original or general themes according to the basic study objectives. As a result, different responses given by various participants were segregated. Subsequently, transcripts were extensively read and initially coded to demonstrate evolving problems using the open coding process. In order to include wider themes for further study, the open coding methodology according to Van den Hoonaard (2012) is about marking particularly related patterns of themes contained in the results. Using the content review method, which included breaking down transcripts into words, word sense, sentences or phrases, the patterns were restricted (Schreier, 2013). In doing so, major ideas arising from the data were allocated to initial codes and these major ideas were identified, which were further reinforced by phrases from the transcripts. In addition, the researcher examined the theoretical and philosophical constructs of this analysis by using knowledge to affirm or refute the theories' implied conclusions. Key phrases or statements were therefore established that may discount or endorse the theoretical structure applicable to this analysis.

Further analysis of data and correlations that exist between literature, conceptual and theoretical frameworks as well as findings unravelled by this study were done from the thematic perspective while incorporating the discussion of related variables of the study.

Methods of qualitative content analysis were utilized in order to conduct the analysis of the acquired data. The text has to be coded, or broken down, into manageable code categories for analysis, in order to do content analysis on the text. These code categories are referred to as "codes." After the text has been classified into code categories, the codes themselves can be further categorized into "code categories" in order to summarize the data in an even more thorough manner.

3.11 Ethical Issues

Codes of ethics specify how researchers can treat themselves before, during and after the conduct of an analysis while maintaining the utmost secrecy of the information they gathered and their respondents (Bachman & Schutt, 2013). There was the need to follow different procedures and adhere to a variety of ethical considerations in the conduct of this research. This was to ensure the reliability of this study while maintaining ethical standards, apart from the achievement of a letter of acceptance from the Department of Accounting, University of Ghana Business School. Any of these variables are detailed below.

3.11.1 Securing consent

The researcher briefed participants (through verbal and written introduction) on the aim and purpose of the study while outlining their role and contributions. I further solicited for their participation in the study while individuals who voluntarily agreed to partake in this study were made to indicate proof of their consent through the signing of a consent agreement form of participation. They therefore trusted me and hoped that the result of the work would help.

3.11.2 Voluntary participation

The researcher informed the respondents that participation was voluntary, and that they could decide to pull out whenever they felt uncomfortable. However, no one pulled out of the interview; they all willingly participated, and I did not need to coerce anyone.

3.11.3 Confidentiality

Confidentiality in research ethics means absolute privacy of the responses provided by respondents. In the conduct of this study, the researcher assured respondents of absolute confidentiality of their responses. In ensuring this, the researcher secured the data generated from respondents while storing them on password-protected hard drives as well as Google drive. Moreover, confidentiality was ensured by denying other researchers, corporate institutions and third parties of the data (responses) but solely used for the academic purpose as already assured.

3.11.4 Anonymity

Anonymity of the participant is the state of masking the detectable personality of the respondent. In the conduct of qualitative research, it is appropriate not to declare the personality of the respondent to the general public. In ensuring this, the researcher used pseudo names rather than the actual names and positions of respondents. Pseudo names such as the common names of respondents were used in order to avoid specificity and breach of anonymity.

3.12 Data Trustworthiness

Trustworthiness of qualitative research is criticized by many. The concept is seen as more obscure since qualitative researchers do not use instruments with

established metrics about validity and reliability. Thus, it is indicated that concepts of validity and reliability cannot be addressed in the same way in naturalistic work (Shenton, 2004). Yet, it was relevant to address these issues by incorporating measures that have been prescribed by Pitts (1994) and Silverman (2001), that a qualitative investigator's study findings should be credible, transferable, dependable and confirmable.

3.12.1 Credibility

Credibility was ensured with the involvement of wide range of key informants whose responses acted as a check on assertions or previous information shared. This form of triangulation involved the use of different methods, including IDIs, FGDs and content analysis of different documents to compensate for their individual respondents' limitations.

The approach acted as a backup or supporting evidence, as suggested by Brewer and Hunter (1989), Guba and Lincoln (1994) and Shenton (2004), which offered additional data to explain the context of the respondents and the phenomena under review.

In addition, the protocols for sampling were found fit to maintain credibility. Although the method for selection was controlled by purposeful sampling, according to Shenton (2004), this ensured that the researcher does not show biasness in the selection of respondents. The unintended and or spontaneous design of the sampling aides on the part of Preece (1994) to ensure that all "unknown influences" are uniformly dispersed across the survey. Both respondents were given the free will to opt out of discussions or interviews at

any time they felt necessary to ensure that respondents were actually individuals who sincerely offered to engage in the research.

Furthermore, Shenton (2004) advises that there is a need for the conscious prevention of lies and exaggerations. For comprehensive results, the author recommended the use of probing to source. In the configuration of the data collection methods and during fieldwork, this method was used. Finally, the willingness of the researcher to link his observations to volumes of established body of information in the topic of the investigation was a primary parameter, which according to Silverman (2001), is indispensable for assessing qualitative investigation works.

3.12.2 Transferability

The prospect of transferability could not be rejected in this study since the findings, though are unique and specific to the study communities, are the reflection of the broader group. One other means of ensuring transferability was to give a thick and detailed description or sufficient contextual information about the subject of inquiry and fieldwork site for future researchers to follow to attain a similar outcome (Firestone, 1993; Lincoln & Guba, 1985). That is the reason for the authors' submission that this is the only responsibility of the researcher, and not to make transferability inferences.

Again, Cole and Gardner (1979), Marchionini and Teague (1987) and Pitts (1994) prescribed that a full description of the type of people who contributed data; the number of study participants; the data collection methods employed; the number and length of the data collection sessions; and the time period over which the data was collected, should be provided. In this report, the authors'

recommendation was carried out with the information given in the problem statement, and the methods followed for this study. It is assumed that comparable findings can be obtained after these measures have been followed and incorporated in a wider context or in a similar situation. Even if multiple studies give conclusions that are not completely compatible with each other, this does not generally mean of course, that one or more is untrustworthy.

3.12.3 Dependability

Reliability and dependability go hand-in-hand to some degree, in the way that the latter is accomplished by attempting to fulfill the former (Lincoln & Guba, 1985). In other words, reliability is the degree to which other researchers can replicate one's study and obtain outcomes that are compatible with the previous. The use of numerous data collection methods, such as FGDs and IDIs, could contribute to reliability assurance (Shenton, 2004). In order to ensure that the conclusions are reliable and can be replicated, it is often labelled as important for the researcher to return to 'inquiry audit' where superiors check and analyze the testing process and data analysis. Therefore, reliability is seen to be accomplished by maintaining integrity, and this analysis has been monitored by qualified evaluators.

3.12.4 Confirmability

About the challenge of minimizing or removing investigator bias (Patton, 1990), frantic attempts have been made to guarantee confirmability, which is the researcher's degree of neutrality in the conclusions and interpretation of the sample (Shenton, 2004). These efforts included providing a thorough explanation of the methodologies used for the research and again the use of

triangulation as a methodological methodology, as recommended, especially in the study data collection process.

3.13 Fieldwork Challenges

In all, there was no major problem encountered in collecting data at the institutional level, aside having to deal with travelling long distances from one premises to the other in the wake of the Covid-19 pandemic with several restrictions on inter-personal relations and communications. At the institutional level, there was a hectic challenge regarding booking appointments with accountants for interview sessions at the ideal time at stipulated on the time plan. This was primarily due to the general lockdown scheduled between March and August 2020, which caused most of the respondents to work from home; hence making them quite difficult to trace.

I was however able to surmount this challenge by getting such data from the respondents after the lockdown while ensuring the requisite social and health protocols at their respective premises for the commencement of the interview sessions.

3.18 Summary

Epistemologically, constructionism or interpretivism philosophy underpins this study. The philosophy opines that reality of a phenomenon is well presented when constructed by the group of people who are faced with the phenomenon. This knowledge guided the selection of case study design, a qualitative research technique to investigate the reality or otherwise of the application of big data in decision making by accountants in multinational companies in Ghana. Informed by the approached used, I used in-depth

interview to source for information from varied respondents (accountants in diverse sectors of multinational firms).

Largely, these respondents were purposively sampled based on their knowledge and practice concerning the subject under investigation. Data was collected mainly in English language between the months of February and August, 2020 with the help of one research assistant recruited for the exercise. Qualitative data which were collected were transcribed and analysed with the help of NVIVo software. A number of problems were encountered on and out of the field, though these did not mar the quality of data collected and the analysis made.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter deals with the presentation and analysis of data collected from respondents in the study area through in-depth interactive interviews. Data was reduced to closely-related narratives and content relatives to facilitate interpretation. This chapter further discusses the results of the study in relation to similar studies conducted in various parts of the world. The discussion was done based on the research objectives as a follow-up to review of related literature presented in chapter two of this work.

4.1 Background Characteristics of Respondents

A total of 12 individuals participated in this study, with majority (8) of them being males. All twelve of the respondents were engaged in interactive face-to-face interviews. The majority of interviewees (9) had post-graduate qualifications in related Accounting and Management programs while the remaining 3 had first degree qualifications in Accounting, Management or Commerce. In terms of experience, it was realized that accountants in most multi-national companies have a great deal of working experiences owing to majority of the respondents (7 out of 12) having ten years or more working experience while the remaining 5 had worked in the accounting sector for not less than five years.

In terms of respondents' involvement in decision making in their respective companies, it was revealed that all the interviewees were members of the Board of Directors of the companies in which they represent. Further enquiry revealed that three (3) of the respondents were members of the executive members of the Board of Directors (BOD) due to the prerequisite insight in management data which makes it ideal for decision making at various levels of their companies' operations.

4.2 Big Data Management Techniques in Multinational Companies in Ghana

In order to investigate the overall big data management techniques that accountants in multinational companies employ, it is prereuisite to ideally quiz respondents' rationality about factors such as; the form (class) of big data used by accountants in multinational companies, how big data is stored in multinational companies in Ghana, analytical technique(s) used in managing big data in multinational companies as well as the level of efficiency (resourcefulness) of big data management techniques in multinational companies in Ghana. The results and analysis of these parameters are presented and subsequently discussed thematically in subsections in an elaborative manner.

4.2.1 Form of Big Data used by Accountants in Multinational Companies

The study sought to find out respondents' perception of the class (form) of big data used in multinational companies in Ghana (in which they work). Emphasis was placed on the nature (structured or unstructured, manual or digital as well as the velocity) of datasets. In some respects, respondents'

assertions on the type of big data used in multinational companies, especially in this modern era, contravened those reported and reviewed by literature. This was not unexpected since according to Benz and Müller (2018), in most cases, transnational corporations (TNCs) often referred to as multinational companies resort to using datasets that are sourced, queried and stored for further analytics.

Yet, there was a general concern by respondents that the ability to effectively query and organize datasets into meaningful schema while applying tags to raw data of similar properties has become increasingly difficult; due to the exponential growth of the velocity and veracity of big data. Consequently, this has propelled most accountants and data managers to use either of unstructured datasets or semi-structured data for analytical decision making.

For example, respondents complained about the increasing rate of the generation of unstructured data versus the structured class (especially in our parts of the world); amidst the analytical and processing tools and software deployed in data mining. Some of the narratives of the respondents are carried in the quotes below:

> *Majority of the data we retrieve from external servers are mostly unstructured with about one-third of it being semi-structured. As it stands now, there is no known efficient scheme by which data of different formats for different purposes from the chunk of data that are generated….*
>
> (Respondent A, Aitel-Tigo)

> *For about six years or more years that I have been in charge of big data mining and management in this organization, the amount of organized data that I have worked with will be about 2% or less. That is to say that the data we accumulate is a mixture of unorganized invoices, transactional details and background data of clients among others…..*
>
> (Respondent B, Zenith Bank)

However, according to Benz and Müller (2018), it is a common practice in banks (and other industries) that business analytics are carried out using structured data. According to these authors, though structured data is not so prevalent in recent years; the application of analytical tools and systems have greatly contributed to the use of structured data in most multinational corporations in the developed world.

4.2.2 Big Data Storage and Management in Multinational Companies

Big data storage, according to Rouse (2017), is a compute-and-storage architecture that collects and maintains massive data volumes while also enabling real-time data analytics (management and processing). She went on to say that in most situations, big data storage relies on low-cost hard disk drives, however lower flash prices appear to have opened the door to adopting flash as the cornerstone of big data storage in servers and storage systems. All-flash systems or hybrids that combine disk and flash storage are available.

In similar regards, this study revealed that accountants and data managers in multinational companies resort to the use of internet-based computing and

storage systems in storing large formats of data. Further probing revealed that, the higher storage capacities needed to store and process large formats of data with varying contents makes it extremely challenging in using less-capacity storage devices that cannot accommodate petabytes and zetabytes of data content. Rather respondents indicated that, cloud computing has been the primary medium of big data storage in multinational companies; but to improve adequacy and efficient transferability of data, accountants in multinational companies resort to system-based approaches and servers that incorporate large content storage software synced with internet-based systems in order to manage data storage. The study further incited that each multinational company has a specially-designed computer storage system that has been synced with internet-based severs that makes it efficient in big data storage. Response from some interview sessions with respondents (accountants) summarise these thoughts as follows:

> *We have the ADPA programming, ADPA is a global motor-firm program so that is what we use in storing most of our datasets. Moreover, Toyota Ghana uses a software we call the Electronic Parts Catalogue (EPC) given to us, at first it was manual in the form of a book that you can flip through, later on they realized that providing volumes of manual catalogue for all the models were tedious so they switched to the EPC for easy access to the voluminous data accrued…..*

(Respondent C, Toyota Ghana)

> *We also use S.A.P (a cloud storage system) in as much as we have our data on hard drives, they are also stored on a cloud. So that is how we store information, we do not store it on any device we lay our hands on, our data storage devices are secured because if the devices are not secured the data would crash so we do not take chances on our storage facilities.*
>
> (Respondent D, Anglo-Gold)

These assertions were further complemented by an insightful expression opined by Respondent E, from Adesco in the quotation below:

> *ADESCO has a virtual system which is drop-box that is managed by an I.T firm and the dropbox is accessible to users based on what is permissible to you so the data is mainly kept online and managed by an I.T firm in the UK…..*
>
> (Respondent E, ADESCO)

While illustrating the analytical tools used in big data management, he further indicated that:

> *We have a system called AQUILA which is also used in all our enterprises and what happens is that the group has modelled an excel sheet which now draws data from it, so we usually export the raw data, which we build into a template for our financial analysis……*

This finding corroborates that of Gandomi and Haider (2015) and Bachman & Schutt (2013) that modern multinational corporations have a greater value for

data confidentiality and management; hence spending huge sums of funds in developing efficient data storage systems.

This finding points to the fact that efficient data sourcing and storage in modern Ghanaian business context is an adaptive concept that is propagated by multinational companies. As other business experts and scholars postulate, this concept has gained much popularity; hence its prevalent use by local small and medium scale businesses.

4.2.3 Big Data Management Efficiency in Multinational Companies

Big data management efficiency is the measure of how data storage and usage across an enterprise impacts the organization's cost and revenues (Paramita, 2016). The concept of the efficiency of big data management techniques has been a difficult index to quantify. According to Willcocks (2014), although the arrival of internet and analytical tools have companies' interaction with their business partners is made easier; on the other hand, no known analytical technique or tool has been able to entirely solve problems associated with data sourcing and management.

This study proved an interestingly-positive efficiency assessment of big data management techniques available for use in various multinational companies in Ghana. This is premised on the level of confidence and interest that respondents exhibited when quizzed about the level of efficiency of big data management techniques in their respective companies. Respondents indicated that the advent of computerised storage systems and specialized wide area network has greatly contributed to easy, swift and efficient methods of data

sourcing, storage and accessibility in and across networked-branches of the same corporation. Below are some extracts from interview sessions signifying the level of efficiency of big data management techniques as perceived by respondents.

> *I think big data management in Stanbic Bank is extremely efficient due to how analytical tools are used to make reports and accurate financial projections. I think our system is perfectively programmed in such a way that irrespective of the format, volume or purpose of the data accrued; it makes it possible to outsource relevant dataset from the chunk with just a few clicks. Moreover, the system is able to automatically read the trends of market forces and can be used to generate meaningful future projections……*
>
> (Respondent F, Stanbic Bank)

> *I am able to generate older information and future projections which I could not do at first. So, there is no stress in designing my own graphs and chats using excel, I can do everything with the click of a button, so for those who are not skilled in all these data processing techniques, tableau has made everything easier. So as a finance person, I think, big data is effective as it provides us with the detailed information we need, so it has made life easier for us……*
>
> (Respondent G, Standard Chartered Bank)

More intuitively, respondents asserted that analytical tools and systems designed for the management of big data has drastically reduced the workload of accountants and data managers; in the sense that professionals who had

challenges with manual techniques of data analysis have had a greater alternative to switch to in order to arrive at same meaningful and organized information to be used for decision making.

Invariably, this finding affirms the opinion of Davenport and Verma (2018), several new technologies, such as Hadoop and other open-source initiatives, approaches to managing streaming data, cloud-based architectures, and new storage hardware environments, have emerged in the last decade, radically changing what constitutes best practice in contemporary data management techniques. These instruments offer far greater value for money than prior technologies, typically by one or more orders of magnitude. Even legacy data management companies are now offering a wide range of solutions and services that include these new technologies.

The indication is that modern analytical tools and systems such as Systems Applications and Products in Data Processing (S.A.P), Tableau, AQUILA and other computer-based systems illustrated by respondents have not only improve the efficiency of data storage and usage but have immensely upheld the level of human resourcefulness in multinational companies.

4.3 Application of Big Data in Decision Making

According to the Management Study Guide (2019), decision making process can be regarded as check and balance system that keeps the organisation growing both in vertical and linear directions. It means that decision making process seeks a goal. The goals are pre-set business objectives, company missions and its vision. Decision making has been ascribed by several scholars and professionals as the core function of accountants. Hence, it is imperative

in modern businesses and corporations that financial accountants assume the roles of business advisors aside the normal routine of index analysis and report they work to generate.

This study sought to assess how accountants in multinational companies in Ghana apply big data in making various inferences and decisions. The analysis and discussion of the findings presented by the study is furthered illustrated in sections below.

4.3.1 Managerial Decisions

Managerial decision is a term used to describe any decision regarding the operations of a firm; decisions include setting target growth rates, hiring or firing employees, and deciding what products to sell or produce less or more. On the rote level of understanding, this level of decision making may appear to be the central responsibility of entrepreneurs or directors; but rather, Owen and Bebbington (1993) had indicated that, accountants play a vital role in making appropriate managerial choices relating to the firm by supplying the required quantitative information about the business, such as financial statements and other kinds of quantitative proof.

More specifically in the conduct of this study, respondents reiterated that their ability to take rational and insightful decisions regarding how much of what to produce, to whom and when to produce as well as decisions on whether or not to expand market through hiring some unique class of employees or setting up branches at specific vantage points are greatly influenced by the availability of big data, analytical tools and systems and knowledge of operation of such analytical tools.

As already incited by respondents in previous sections of this chapter, the prerequisite knowledge and skills possessed by accountants in multi-national companies to use business analytical tools and systems such as AQUILA, SAP, Tableau and Electronic Parts Catalogue (EPC) among others have improved the efficiency of various aspects of managerial decisions in their respective companies. The following excerpts reveal respondents' experiences in how big data contributes to decision making in multinational companies in Ghana.

> *The efficient management of big data makes it possible for our company to know investments that are performing and investments that are underperforming, and to a larger extent it also allows the business to be able to forecast our future trends and it also allows management to make decision regarding investment, there are a lot of investments that the company eventually had to disinvest because we could use the data to project that these investments will not help the company……*
>
> (Respondent D, Anglo-Gold Mining Company)

Affirmatively, Respondent E from Adesco added to it that:

> *Knowledge about progress indexes makes management to make managerial decisions regarding closure of offices in areas projected to be under-developing; based on the cost-revenue scale of the said branch. In the same way management is able to assess and know if whatever the company is spending resources on is creating enough value for the company and the cost it incurs on that. So, for me, big data presents an opportunity for management to be able to forecast*

ahead, to take corrective actions, and also to be able to make decisions regarding what investments to keep and what investment to let go off and it allow us to be able to predict what kind of entities to invest in in future based on our ability to analyze their financial inputs and then determine some patterns

(Respondent E, ADESCO)

Thus, unlike most small and medium-scale entities that operate with primitive and manual data management systems in the Ghanaian context, multinational companies on the other hand are data-oriented in making decisions pertaining to managerial roles. While most small-scale businesses make such decisions on the basis of instincts, personal relationships and feelings, accountants in multinational companies are informed by the analysis and projections underpinned by big data for more accurate and scientific decisions.

Despite the fact that measurable information is crucial for decision making, according to Bowerman and Hutchinson (1998), accountants do not use it due to a lack of relevant methodologies. These writers also stated that they are not seen to make a beneficial contribution to decision-making unless it is to legitimate conclusions reached through a democratic process. Rather, the findings presented by this study as well as the study conducted by Management Study Guide (2019) clearly point out accountants' role in managerial decision making to a different direction. Bowerman and Hutchinson's assertion could be attributed to the low level of big data and management analytics in the late 90s versus the prevalence of efficient tools and systems used in data management in modernity.

4.3.2 Strategic Decisions

According to Yue and You (2014), strategic decisions are those decisions that have an influence over years, decades and even beyond the lifetime of the project. These authors further clarified that such decisions are hard to be changed or modified in a short period. The study revealed that accountants in multinational companies in Ghana make strategic decisions by devising time-efficient steps to redistribute a major portion of their firms' resources in order to stay competitive and significant to their customers for a longer period of time.

Quite similarly, respondents indicated that the Board of Directors of their respective companies (of which they form a part of) engages in various levels of strategic planning and decision making when necessary to uphold and ensure the successful thrive of the companies in forthcoming years. According to respondents, they engage in strategic planning in order to salvage their companies from market risks such as extreme fluctuations and depressions as well as dwindling market forces and inflationary misfortunes. The excerpts presented in quotations below further illustrate respondents' clarification on how big data is applied in making strategic decisions.

> *The efficient management of big data enables us to make critical strategic projections; in the sense that the greater command I have over big data analytics has helped this company to salvage a huge investment plan projected to 2024 from failing due to Covid-19 but rather the efficient and swift analysis of market trends has made it*

possible to remedy the situation to a steady pace. Moreover, we have already done reviews of the strategic paper showing how certain key indexes in the money market will be faring in upcoming months and years. So, management is able to make strategic decisions where we have written various plans such as best- and worst-case scenarios, spelling out how the next two to three years will look like while guiding our operations in attaining our targets……

(Respondent F, Stanbic Bank)

One respondent (an accountant from Nestle Ghana Limited) added to it that:

The efficient storage and accessibility of big data through the use of the MAGNITUDE and SAP has greatly contributed to our success story. Due to this, we have been able to sort out consumer preferences, trend of demand and supply forces and market demand schedule for various products which makes it possible to make projections and estimates into future prices and revenue scales for the purpose of drafting insightful reports……

(Respondent H, Nestle Ghana Limited)

These findings corroborate with a report by Management Study Journal (2019) that corporate strategic decision making is successful in modern businesses because of the availability of a more reliable component (big data) which serves as a "glue" to bind the organization to its long-term sustainable goals. In the same context, Arora (2018) was of the view that initially, enterprises were lacking efficient techniques which resulted in a huge limitation to information-oriented decision making, but with the evolution of big data

businesses have got some direction and well compiled and analysed information that is used by the organisations to take the decisions.

4.3.3 Financial Regulatory Decisions

The study unravelled that respondents' perception on financial regulatory decisions pointed out that financial regulations are various supervisions, which subject financial institutions and business entities to certain monetary requirements, restrictions and guidelines, aiming to maintain the stability and integrity of the financial system. Further, respondents clarified that financial regulatory decisions entail all decisions made by companies aimed at ensuring the stability of such companies through meeting monetary requirements.

Moreover, the study revealed that such financial regulatory decisions such as tax requirements, employees' wage rates, annual revenue targets and pricing mechanisms are quite difficult to keep up except for the advent of big data analytics that has brought about a systematic and definite data sourcing and analysis procedure. More significantly, other scholars have earlier indicated the immense contributions of big data analytics towards making financial decisions in modern economies.

Centrally, extracts from the findings generated in this study (as provided by respondents) are illustrated below:

> *As I said earlier, whatever transaction that we are recording on our enterprise resource planning system has a tax component, so the data of the tax component also goes into the big data and at the end of the month, we have different transactions that we use to generate our tax report, so the transactions that we have made will also do an analysis*

on the big data and generate the report that we need. So, for our monthly VAT, withholding taxes and payees, we have transaction codes on the SAP that we run and it does the analysis on the big data to generate report. That is how we do the tax reporting, so for tax we do not do anything manually, everything is in the big data and we have transaction codes that run the analysis to generate the report……

(Respondent I, Mondanese International)

Big data analytics enables us to identify some of the financial parameters that we are able to keep track of. We are able to evaluate the profit restrictions, subsidy rates and tax rates of our company. Moreover, the background information and financial records of our employees that we accumulate enables us to estimate the amount of social security contribution that each employee pays and factor it in our decision making about pension schemes or insurances.

(Respondent A, Airtel-Tigo)

Regardless of the merits associated with big data in making financial regulatory decisions, a respondent made an assertion that although big data contributes to swift and efficient data-oriented decisions, there is a little contribution of the concept of big data towards financial regulations. An excerpt from his statement is quoted below:

With regard to taxation, taxation structure is a specialized data; it is a fixed algorithm of which big data cannot make much difference in. So big data helps us in the presentation of reports and generating of

financial statements and interpreting the results but when it comes to taxation, the application of big data is very limited…..

(Respondent G, Standard Charted Bank)

However, Hussain and Prieto (2016) have opined that the advent of big data in financial services has brought about numerous advantages to financial institutions and business entities. These authors further suggested that irrespective of the challenges associated with big data analytical tools and systems, this concept has terraced the face of financial regulations and decision making. According to them, efficient management of big data has made it possible to keep track of financial and transactional data in an attempt to establish an accurate data-frame for the purposes of maintaining tax requirements, salary structure and cash-flow targets.

Similar to the view of Respondent G, Wilkinson and Wyman (2018) are of the view that, the application of big data is not entirely feasible and homogenous in sectors of the economy; thus, its use in financial decision making is quite limited to its ability to detect unusual patterns early so that financial analysts may be able to prevent breaches rather than responding to them after they have occurred. In the view of Wilkinson and Wyman (2018), financial regulation will minimally be impacted by incorporating big data analytics in its pivotal fulcrum but not entirely inevitably.

4.4 Challenges of Big Data Analytics in Multinational Companies

Challenges are known to be hindrances that obstruct the smooth attainment of a goal or purpose. As generally conceptualized by many, the introduction of

any new technique or technology brings about some level of inconsistency and hitches regarding the ability of staff to adapt to the new technology. This study proved similarly that, old and manual systems of data sourcing and analysis subjected accountants to glue to primitive methodologies of data presentation and decision-making procedures. Rather, most accountants in Ghanaian entities were relatively comfortable with such orthodox system of analytics until the advent of big data management and modern analytical tools. Respondents keenly expressed that, the dynamism brought about by modern technologies and analytical systems in multinational companies demand some prerequisite skills and knowledge needed for the efficient utilization of these analytical systems and techniques. Consequently, the relatively lower supply of skilled labour (with adequate skills and knowledge) in the Ghanaian context coupled with the slower pace of technological advancement of the sub-region owing to lower information literacy and technological infrastructure of Ghana have militated the smooth operationalization of big data management in most multinational companies in Ghana.

More significantly, this section of the study lays much emphasis on exploring the key challenges that accountants in multinational companies in Ghana encounter in pursuit of using big management and data-oriented decision making. In this regard, specific challenges are presented and discussed in sub-sections subjectively below.

4.4.1 Big Data Sourcing

Big data sourcing; also termed as data mining is a term used to describe processes involved in tracing and accumulating facts, figures and large datasets while outlining patterns and correlations that exist between such variables and the purpose of the organization. While exploring respondents' perception on the techniques of big data sourcing in their respective multinational companies, it was established that data mining or sourcing is extremely difficult task to do manually; hence they resort to various soft-wares available in their respective companies to automatically trace and accumulate the plethora of information about customers, employees and other operations that are inputted in the system. They further reiterated that, though there is no efficient algorithm that commands such data management systems to sort and organize data of similar or same schema or tag, but rather the ability of such analytical tools to store and regenerate access to this chunk of big data is at least time efficient and less cumbersome. A study conducted by Kade (2019) suggested that redundant data integration from several unmarked sources lead to great privacy concerns that obstruct the efficient sourcing of big data. According to him, this happens due to the fact that, analytical tools and systems are not objective but subjectively incorporate the commands that are given them.

However, extracts from interview sessions (as outlined in quotation below) point out some of the accountants' challenges of big data sourcing in multinational companies.

> *Yes, we do face some challenges when it comes to sourcing big data, particularly from older version of an analytical system. I recall an*

incident where a client made a deposit in 1998 but passed away few months later, and years later his next of kin wanted to retrieve the money but we couldn't find the data for the deposit because it had been long, and we had changed the program we were using to run the company at that time. We were using NX at that time, but we now use ADP, and the ADP cannot retrieve that information from the NX because they are different softwares, so that became a big challenge because they had all the manual documents to prove the client indeed made such deposit but there was no way we could verify it in our system……

(Respondent C, Toyota Ghana)

More so, Respondent F from Stanbic Bank added that:

One keen challenge we encounter in data sourcing has to do with privacy concerns of clients. For instance, sourcing data to determine the income stream of customers to make decisions regarding investment plans or financial regulatory decisions become very unreliable. This is because, clients become very reluctant in providing complete information about their financial stance which makes it inconsistent for our system to accommodate; hence making data sourced from our system very limited in terms of validity and reliability.

(Respondent G, Stanbic Bank)

As already presented by Kade (2019), responses from Accountants 3 and 8 show a great positive correlation that big data analytics in multinational

companies is not as efficient as earlier asserted by Owen and Bebbington (1993). Although this study does not entirely subject the findings of Owen and Bebbington (1993) to extreme criticism, but rather it points out salient challenges that exists in accountants' pursuit of utilizing big data analytics which ought to be addressed. It can be deduced that most of such challenges are context-oriented (specified to a unique context due to prevailing factors); for instance, response from Mr Agyei, from Stanbic Bank. Though most analytical systems only work on the basis of the GIGO (Gabbage-In, Gabbage-Out) principle, which makes it unable to determine complete or false information provided by customers, the reluctance of customers in the study area (Accra, Ghana) in providing details pertaining to their financial status is an index that can be regarded as an exception; hence generating a new strand of challenge in big data management.

4.4.2 Big Data Analysis

Data analysis is defined as a process of cleaning, transforming, and modeling data to discover useful information for business decision-making. According to Guru (2020), the purpose of data analysis is to extract useful information from data and taking the decision based upon the data analysis. However, it is inevitable that datasets that fall short in various aspects of consistency, validity and reliability will obviously be limited in efficiency in terms of the analysis.

Challenges that often arise in the application of big data analytics are the limitations of big data in making predictive analysis (an analysis that shows "what is likely to happen" by using previous data). In this regard, respondents indicated the extent to which multinational companies in Ghana encounter challenges in their quest of using big data in making statistical, diagnostic,

predictive and prescriptive analysis. Further probing revealed that, accountants in such companies find it challenging in using big data to make inferences from their firms' previous operations in order to analyze and understand why and how certain indexes and decisions were met. Aside challenges pertaining to diagnostic analysis, accountants also face a great deal of obstruction in using analytics to make statistical analysis of their respective companies, which consequently affects their ability to make accurate predictive analysis for further recommendations (prescriptive analysis).

Excerpts from respondents' statement outlining key challenges which accountants face in using big data analytical tools and techniques are ascribed in quotes below:

> *It is difficult to have the best of big data in our company due to the special skills and knowledge needed for its use. More often, these demands investing in special training and technology infrastructure to be able to equip staff with the needed skills for deploying big data analytical systems and techniques. Our inability to fully invest in this has resulted in our inability to make rational and accurate predictive analysis of our cash-flow indexes. Comparatively, high information literacy and technological advancement in developed countries such as UK have enabled expert accountants in our headquarters and other branches to predict the outcomes of market tends, quarterly producer price levels and revenue targets, while being able to assess and analyze feasible and SMART recommendations for the substantial growth of the company. In our case, it is very challenging to make such*

analysis with the level of skills and knowledge of big data analytical systems and techniques we have.

(Respondent I, from Mondanese International)

Personally, I have great displeasure of making diagnostic analysis of various kinds. This reminds me of a project I which was assigned to analyze the statistics of the financial indexes of our customers in the informal sector from early 2000s till last quarter. Due to the low level of technological advancement in our part of the world, I had a great deal of challenge while sourcing data from our previous server to be able to make a valid analysis. The results of the analysis were so skewed that data in the early 2000s was about one-tenth of the entire dataset for the entire project, making it unreliable. On face value, big data analytics was rather to generate a more rational and reliable analysis to be used for further decision making but that was not always the case in our company.

(Respondent G, Standard Charted Bank)

These findings correspond to Webb (2018) which stipulates that inaccurate data keyed into analytical systems through manual errors during data entry can lead to significant negative consequences if the analysis is used to influence decisions. While Kumar (2018) insists that, the application of big data in making various strategic analysis and decisions is very limited in areas where network and data infrastructure is not at its peak, the deduction that could be made from this is that big data and the management technique does not solely

operate on its own, hence the unavailability of environmental and human resources to render it useful makes it less efficient in its application.

While Respondents I and G suggest that there are some challenges in using big data for various analysis purposes, Respondent H from Nestle Ghana Limited opposes that:

> *Okay so we do not have many challenges because right now we don't have many inaccuracies so the process doesn't have too many challenges, it is almost flawless if I should say. It is difficult to pinpoint any challenges at the moment; we don't really have too many of them……*
>
> (Respondent H, Nestle Ghana Limited)

Aside the numerous challenges illustrated by other scholars and respondents in this study, Respondent H from Nestle Ghana insisted that he could not clearly point out to any keen challenge in the application of big data and its related systems and techniques in their quest of making accurate analysis and decisions. Although, Kumar (2018) had earlier outlined that the basis for most challenges encountered accountants using big data for diverse analysis is the level of technological advancement and information literacy of the firm, response from Respondent G indicated that there could be a new dimension to the probability of encountering various degrees of challenges. For instance, accountants in financial institutions who are inclined with making higher-order financial analysis may demand more multi-faceted and sophisticated datasets than companies that only analyze trivial and ordinary sequences. In

this regard, this analogy makes Nestle Ghana Limited to have relatively no significant challenge in using big data.

4.4.3 Big Data Application

As already reported by the findings of this study, the contribution of big data to the decision making of multinational corporations have become inevitable in modern business settings. However, the total dependency of accountants and data managers on big data for the purpose of decision making is subjected to a series of challenges ranging from its reliability, validity and accuracy. The findings of Owen and Bebbington (1993) suggest that the inability of human resources to efficiently harness big data has brought about data inadequacies that misinform analysts and decision makers to take decisions that are irrational.

In the same vein, this study has revealed that the extent of reliability of the application of big data in making strategic, managerial and financial regulatory decisions is subjected to few challenges which in turn affect such decisions taken by multinational companies in Ghana. Respondents further indicated that, making decision with big data is spearheaded by three main variables: time, accuracy and quality. In this regard, big data analytics greatly enhances time efficiency while accuracy and quality indexes are adversely impacted due to inconsistencies and redundancy of data that are generated. Due to the labour-intensive nature of the orthodox manual system of data analysis and decision making, accountants and Board of Directors of various multinational companies resort to the use of data-oriented system of decision making whereby data generated is simplified and queried either for statistical, diagnostic, predictive and prescriptive analysis for the purpose of making

informed decisions. However, respondents added that relying on big data to make such decisions has not been as smooth as the case of their fellow accountants in same companies in developed parts of the world.

The following excerpts further outline the views of respondents on the challenges they encounter in the application of big data for decision making.

> *The challenges associated with big data analytics are much felt especially when making decisions regarding project management. This is because either of the three decision variables (time, quality and accuracy) is sacrificed to attain the other. Since our system is programmed to ensure time-efficient data sourcing and analysis, the accuracy of decision is adversely impacted. More often than not, this becomes misleading and inefficient because projects and concessions that ought to be analyzed from social and scientific points of view in order to make further S.W.A.R.T analysis for effective decisions are predetermined by solely relying on scanty data that fail to take into account other significant information…*
>
> (Respondent D, Anglo-Gold Mining Company)

> *The main problem we encounter in decision making is time inefficiency. This is because, for swift and accurate decisions to made, data and statistics ought to be readily available and accessed for further analysis in order to make predictive and prescriptive decisions. On the other hand, access to big data is strictly treated discretely as compared to the manual system of data management where everyone can have access to data presented in archives, invoices and logbooks.*

> *In this case, the absence of the chief accountant or data manager means none other can have access to the system log-ins.*
>
> *There have been several instances whereby urgent classified datasets are needed to be accessed for urgent decisions to be taken, but our inability to access big data from the analytical system led to the failure of such decision making.*
>
> (Respondent E, ADESCO International)

Although Bhimani (2015) and Chen and Zhang (2014) have earlier suggested that big data enables firms to make informed decisions while ensuring innovation in decision making, the findings presented by this study seem vis-à-vis with Patil (2017) opinion that one major challenge in big data application is the scalability-constraint of the applications. Several organizations are facing the same issue where the volume of data has been increasing each passing day. Due to the multiple layers between the data-base and front-end, the data traversal takes time. On top of that, this study has revealed that inability of big data to be accessed by homogenous class of staff; that is, limitation on who can have access to data for further analysis in some multinational companies in Ghana adversely affects the pace and efficiency of decision making. Although accessibility does not seem to be a major challenge in other developed regions, the problem of scalability-constraints (as pointed out by Patil) seems to be a universal challenge.

On the other side of the coin, Respondent A, from Airtel-Tigo insisted that:

> *I do not think there are any significant challenges in the application of big data for decision making. This is because our system is able to*

trace, store and query quantitative, qualitative and geographic data; which makes it multifaceted and ideal for making diverse decisions pertinent to financial, social and tracking purposes. For me I think big data incorporates all the needed information so you won't face challenges at all in using big data…….

(Respondent A, Airtel-Tigo)

The deduction that can be made from this finding versus the response of Mr Joseph is that the Human Resource Management System (HRMS) together with other inter-based data management systems specially designed for efficient data management greatly contributes to meeting the basic needs of the company. However, this does not guarantee a flawless system of data analytics as opined by Respondent A but rather the analytical tools provide a fairly greater chance of sourcing most prerequisite data from clients that enables data analysts to make various inferences and querying for decision making.

4.5 Summary of Findings

This section of the study presents the analysis and discussion of major findings revealed by this study versus the theoretical and conceptual frameworks presented in previous chapters of this study.

4.5.1 Empirical Evidence versus the Conceptual Framework

The results from the study show that majority of accountants having had post-graduate qualifications in related Accounting and Management programmes are well-experienced in accounting strategic and big data management. More so, the research findings point out that big data often used in multinational

companies in Ghana are unstructured datasets with no ranging from surveillance data, audio, document collections, invoices, records, emails, productivity applications, internet of Things (IoT) and sensor data, among others

With these, accountants in multinational companies in Ghana resort to the use of internet-based analytical systems and techniques such as ADPA, Electronic Parts Catalogue (EPC), S.A.P, AQUILA, Hadoop and Tableau among others. Respondents further indicated that, though most of these analytical systems are efficient in data sourcing and storage, they complement them by simpler and manual systems like Ms Excel. Further enquiry into the study revealed that the application of the aforementioned analytical systems and techniques have proved worthy in efficiency. Although an accountant in Nestle Ghana Limited insisted that big data analytics has some few challenges in sourcing and storage, its analysis and decision-making ability really proves to be better among other alternatives.

Comparatively, respondents pointed out that big data analytics is applied in almost all sectors of their respective companies towards making various strategic, managerial and financial regulatory decisions; as ascribed in the conceptual framework presented below in **Figure 2.0.**

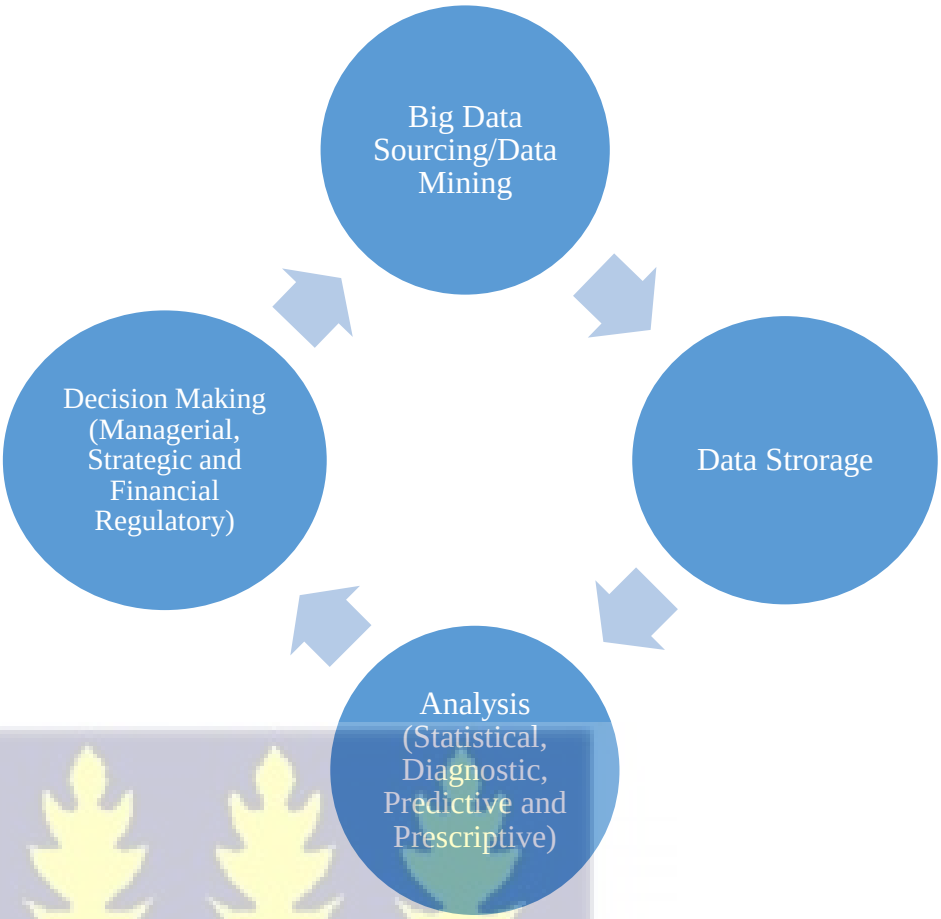


Figure 2.0: Empirical Evidence in Relation to the Conceptual Framework

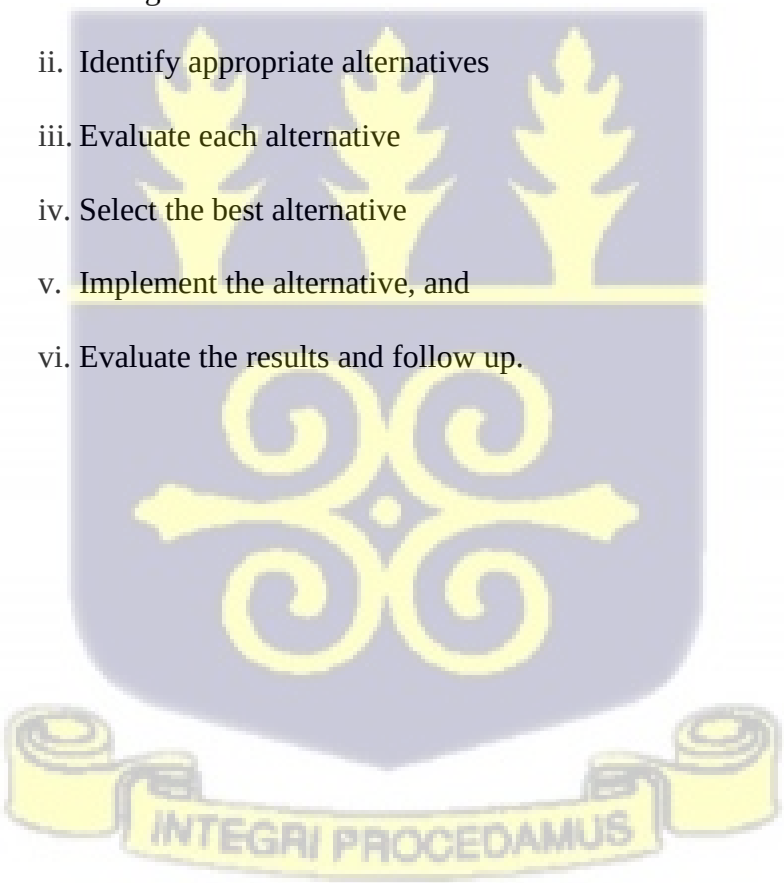
Source: Author's Construct, 2020

4.5.1 Empirical Evidence versus the Theoretical Perspective

As opined by authors such as Bebbington and Owen (1993), big data analytics has continually been a challenge since its advent. It is this reason that necessitated the proposition of the Database Design theory to cater for the various challenges ranging from data redundancy and constraints for accurate and reliable analysis and decision making. However, this study proved the existence of several challenges regarding big data sourcing, analysis and its application in decision making. Similar to the Codd's model, this study

outlined that data redundancy and constraints such as incompleteness are the most severe challenges that accountants in multinational companies face in their quest of using big data analytics. In this regard, Adams Smith's (1937) Agency theory of management serves as a blue-print on which accountants and multinational companies ought to follow in order to harness big data to arrive at achieving accurate and time-efficient decisions. In more precise terms, Herbart's (1947) Decisions Theory of management prescribes a set of organized procedures needed for managers and decision makers to implement while making various decisions; they include the following.

i. Recognise and define the decision situation
ii. Identify appropriate alternatives
iii. Evaluate each alternative
iv. Select the best alternative
v. Implement the alternative, and
vi. Evaluate the results and follow up.



CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes the findings derived from the analysis and discussions of the results. Conclusions are drawn on the application of big data in decision making based on the findings. Finally, recommendations are made for the study.

5.1 Summary of Major Findings

The following are the major findings from the study:

- Almost all the parameters analyzed in the study by respondents pointed out to the fact that accountants in multinational companies in Ghana are fond of using big data management systems such as ADPA, Electronic Parts Catalogue (EPC), S.A.P, AQUILA, Hadoop and Tableau. The advent of such computerized storage systems and specialized wide area network has greatly contributed to easy, swift and efficient methods of data sourcing, storage and accessibility in and across networked branches of the same corporation. Regardless, accountants reiterated that the ability to effectively query and organize datasets into meaningful schema while applying tags to raw data of similar properties has become increasingly difficult due to the exponential growth of the velocity and veracity of big data. Consequently, this has propelled most accountants and data managers to use either of unstructured datasets.

- The study revealed that accountants in multinational companies in Ghana resort to the application of big data analytics in making various managerial, strategic and decisions relating to financial regulations. More specifically, respondents indicated that statistical analysis of big data helps in making managerial decisions such as setting target growth rates, hiring or firing employees, deciding how much of what product to produce, for what class at when as well as decisions to expand market through hiring some unique class of employees or setting up branches at specific vantage points. Furthermore, accountants opined that big data analytics is a useful tool in making strategic decisions salvaging their companies from market risks such as extreme fluctuations and depressions as well as dwindling market forces and inflationary misfortunes; aimed at sustaining their companies for years ahead. It was revealed that the role of accountants and financial managers to make financial regulatory decisions such as tax requirements, employees' wage rates, annual revenue targets and pricing mechanisms are solely premised on efficient analysis of companies' cash-flow analysis through the application of big data analytics. On top of that, this study affirmatively suggests that the application of big data in various spheres of decision making has ensured time-efficiency, accuracy and quality of decisions.
- This study revealed that although big data analytics has greatly contributed to decision making in multinational companies in Ghana, the challenges associated with its application has immensely altered its reliability, validity and accuracy. According to respondents, challenges

associated with big data sourcing such as the existence of no efficient algorithm that commands such data management systems to sort data of similar or same schema or tag, redundant data integration from several unmarked sources and privacy concerns are key issues that obstruct the efficient sourcing of big data. Notwithstanding that, the accuracy and reliability of diagnostic, statistical, predictive and prescriptive analysis done in multinational companies in Ghana face a great deal of obstructions due to data redundancy and manual errors during data entry; hence leading to a significant negative consequence if the analysis is used to influence decisions of such companies.

5.2 Conclusion

The study focused on analysing the concept of big data in multinational companies in Ghana and its application in decision making. Based on the key findings, the study concludes that accountants in Ghanaian MNCs like adopting big data management solutions including ADPA, Electronic Parts Catalogue (EPC), S.A.P., AQUILA, Hadoop, and Tableau. There has been a dramatic improvement in the ease, speed, and efficiency with which information may be gathered, stored, and accessed inside and among networked branches of the same organization since the introduction of such computerized storage systems and specialized wide area network. The research also shows that big data analytics is used by accountants in MNCs in Ghana to make managerial, strategic, and decision-related to financial rules. More precisely, managerial decisions like setting target growth rates, hiring or firing employees, determining how much of what product to produce, for what class, and when, and deciding to expand market by hiring some unique

class of employees or setting up branches at specific vantage points, all benefit from statistical analysis of big data. Moreover, the work of accountants and financial managers is predicated on efficient analysis of organizations' cash-flow analysis through the application of big data analytics in areas such as tax needs, employee salary rates, yearly revenue objectives, and pricing mechanisms.

The research concludes that multinational corporations in Ghana benefit substantially from the use of big data analytics, but that its trustworthiness, validity, and correctness are greatly compromised by the difficulties inherent in its deployment. Key obstacles that impede efficient sourcing of large data include the lack of an efficient algorithm that orders such data management systems to sort data of similar or same schema or tag, duplicate data integration from numerous unlabeled sources, and privacy concerns. Even so, there are many obstacles to the accuracy and reliability of diagnostic, statistical, predictive, and prescriptive analysis done in multinational companies in Ghana due to data redundancy and manual errors during data entry, which could have serious consequences if the analysis were used to influence decisions in the companies

.

5.3 Recommendations

This study has indeed shown that the big data-decision-challenges linkage is highly context-specific, and therefore requires certain specific policies to deal with the issues. However, recommendations to active players and agents pertinent to this concept are outlined in sub-sections below.

5.3.1 Recommendation to Accountants and Data Managers

In an attempt to overcome the challenges of big data, it is expected of accountants in multinational companies to:

- Engage in personal professional development agenda in order to stay abreast with modern techniques in data management. This will equip them with the prerequisite skills and knowledge needed for sourcing, storing and query of big data for decision making.

5.3.2 Recommendation to Multinational Companies and other Business Entities

The study recommends that, multinational companies and other business entities should:

- Establish the need for big data and identify the right type and sources to be used. By so doing, accountants and data analysts will not have to be distracted by repetitive and irrelevant data in their efforts to analyse them.
- Invest in training their staff to meet modern standards of data management through in-service training, internships and career development sessions

- Adapt to the use of more efficient and simplistic big data management system rather than sophisticated and less-effective one. This will ensure that, staff with at least average knowledge and skills in data analytics have great command in using big data analytical tools.

5.3.3 Recommendation for Further Studies

Even though the study was able to achieve what was set out to achieve, the researcher came across certain areas which could be explored in future studies. Such areas include the following:

- Application of in-memory analytics in multinational companies in Ghana. The use of in-memory databases to speed up analytic processing is increasingly popular and highly beneficial in the right setting; hence, it is imperative to conduct a study to assess the applicability of this concept in their context.
- Exploring the merits of in-memory database in data management. The use of in-memory databases to speed up analytic processing is increasingly popular and highly beneficial in the right setting. It is recommended for further studies to be conducted to explore the advantages of this database.
- Big Data Engineering. This study will explore the attempt of data scientists in data organization to meet a structured and reliable standard.

5.4 Contribution to Knowledge

The study has added to the literature on big data analytics in Africa; specifically, looking at the application of big data in decision making in multinational companies in Ghana. It has also added to the literature on challenges associated with big data application by accountants. Finally, the research has made some recommendations which, if followed, can improve data mining, analysis and application of big data in decision making by business entities.

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APPENDIX A

INTERVIEW GUIDE FOR ACCOUNTANTS

BIG DATA AND DECISION MAKING AMONG ACCOUNTANTS IN MULTINATIONAL FIRMS IN GHANA

INTRODUCTION

The researcher is a student of the University of Ghana (Business School) and is soliciting for your resourceful insight for the conduct of a study dubbed: **Big Data and Decision making in multinational firms in Ghana.** The information you provide will be treated as confidential and will be used solely for academic purposes. Thank you for your time and cooperation.

SECTION A: PERSONAL DETAILS OF ENUMERATOR (INTERVEIWER)

- Name of interviewer: ……
- Date of interview: ……..

SECTION B: Big Data Management Techniques

1. What form (class) of big data does your firm use in its operations?
2. How do you store big data accrued in your firm?
3. What analytical technique(s) do you employ in managing big data in your firm?

4. How efficient (resourceful) are these management techniques you use?

SECTION C: How Accountants use Big Data for Decision Making

5. How is Big Data utilized in making managerial decisions in your firm?
6. Describe how big data is utilized in making strategic decisions in your firm?
7. Explain how big data is used in making financial regulatory decisions?

SECTION D: Challenges Accountants face in using Big Data

8. What are the challenges you encounter in big data sourcing?
9. Elaborate on the various challenges you encounter in big data analysis and analytics?
10. What challenges do you face while utilizing big data in decision making of your firm?

SECTION E: Recommended Measures to Address Challenges

11. What measures would you recommend in remediating the challenges outlined above?