

# BIG DATA PARADIGM AND NIGERIA STOCK EXCHANGE INFORMATION SYSTEM

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**Abstract** *The global shift by the financial industries towards data-driven market exigencies brought big data analytics to fore and engendered the write-up of this paper. The paper is entitled; big data paradigm and stock exchange information system. The embrace of big data paradigm is viable for this information technological era. Therefore the paper examines the qualities of big data and its imperativeness, the stock exchange, and the possibilities of making shift through incorporating this into the financial sectors in Nigeria especially stock exchange for contemporary gathering of data and timely analysis for competitiveness globally. Therefore, some recommendations were proffered that the financial institutions; Nigerian stock exchange should make do with this analytics due to the unprecedented enormous data that stream into the industry in diverse forms and at very high speed.*

**Keywords:** Big Data; Information system; Financial Sector; Analytics and Paradigm

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## INTRODUCTION

The present era of globalization is termed as an information explosion era and it is a world that is overwhelmed by statistics, symbols and digits. Globally, it is frequently referred to as information age. Trevir (2019) recognised the fact that there is a vast proliferation of data and increasing technological complexities, and these continue to transform the way industries operate and compete. Trevir (2019) stated further that over the past few years, 90 per cent of the data in the world has been created as a result of the creation of 2.5 quintillion bytes of data on a daily basis. Financial services in particular have widely acknowledged the flow of globalization thereby adopting big data paradigm to inform better investments decisions with stable yields.

This 21<sup>st</sup> century is a data-driven era, where the financial industries are extremely reliant on data. Based on this Kelvin (2016) stated that there is need to bridge data analysed with the current trends and the traditionally analysed data to improved business models in order to meet up with the emerging market issues internationally. Noteworthy of it is that a systematic processing and analysis of big data

is the underlying factor. The phenomenon of big data analysis is continually growing as organisations are remodelling operational processes. Hence, this relies on live data with expectations of improving customer engagement, driving effective marketing techniques in industry and to potentially provide innovative products and services.

Due to enormous inflow of data in financial industries big data becomes a point of attraction. Big data is opined by Segal (2019) to be large and diverse sets of information that grows at ever increasing rates. Big data encompasses the volume of information, the velocity or speed at which it is created and collected and the variety or scope of the data points actually covered. Big data often comes from various sources and comes in numerous formats. Though, big data paradigm is relatively novel but the act of collecting and storing enormous amount of information for eventual analysis is relatively old (Baumann & Riedel, 2020).

Baumann and Riedel (2020) opined that big data can be analysed for insights that lead to better decisions and strategic business moves. This quality make big data viable for

accounting industries, therefore, Rembert (2020) asserted that accounting industry is rapidly shifting with the economy as a whole toward a data-driven market predicated on analytical expertise and precision. Rembert (2020) acknowledged that big data can allow accounting professionals or stock exchange to look at the performance of a particular industry and see shifts in customers' behaviours or trends. Combining big data with savvy analysis, financial institutions will be able to easily spot possible signs of fraud or even anticipate the manner in which economic wind is blowing (Rembert, 2020). This may also forestall unfair practices of using undisclosed information (Akinsulire, 2011).

Lima, Portela, Santos, Abelha and Machado (2015) stated that the financial sector and information technology behaviours are changing rapidly that financial industries globally are making do with Big Data to transform financial processes because it creates value for the industry. Therefore, the paradigm is promising and differentiating for financial services sector for better informed decisions with stable yield to stakeholders. The stock exchange should acknowledge and embrace the four Vs qualities; velocity, variety, volume and veracity of big data in gathering and analysing the enormous data streaming into the industry in diverse forms through different media in predicting it financial activities and to create strategic business moves.

The objective of this work is to appreciate and avocate the implementation of big data and its value creation in organizations. Therefore, Nigerian Stock Exchange should leverage its financial services and transform the sector's financial processes by embracing big data analytics.

### **CONCEPT OF STOCK EXCHANGE AND INFORMATION SYSTEM**

Financial industries are rapidly shifting with the global economy toward a data-driven emerging market centred on analytical skill and accuracy, because big data is finding its route in all facets of existence. Sophie and Russell (2018) opined that big data was first captured in biomedical informatics academic literature in the early 2000s and only emerges in accounting and finance literature around

2011. According to Baumann and Riedel (2020) the model became renowned in early 2000 when industry analyst Doug Laney uttered the now-mainstream. Therefore, noteworthy is the current strides of big data in continuing transformation of the landscape of various industries, particularly financial services (Trevir, 2019). Big data is one of the business words of the last few years because it has tangible effects and benefits that reach across industries internationally (Rembert, 2020).

Sophie and Russell (2018) asserted three basic areas that big data analytics offers competitive edge in accounting and finance sectors, specifically these were stated as customer insights, decision making and fraud detection and prevention. The organisation's data comprise transaction and operation data that are meant for forecasting and analysis in accounting and finance. A huge of this data are mined and analysed in stock exchange which is one of the financial industries. Stock Market which can be interchangeably referred to as stock exchange, though the latter term is generally a subset of the former and has widely embrace the big data analytics globally (Segal, 2019; Chandra, 2011).

Stock exchange is a market place where securities such as shares and bonds that have already been issued are bought and sold (Chandra, 2011). Chandra, (2011) stated the listed securities as securities that are listed on various stock exchange and hence eligible for being traded. Financial markets are focusing on data-driven investment models because financial institutions such as banks are rife with transactions running into hundreds of millions daily (Sophie & Russell, 2018). A stock exchange is a centralized location where the shares of publicly traded companies are bought and sold. Capital are raised and investors are avail the opportunity to make informed financial decisions using real-time price information either in a physical location or on an electronic trading platform (Chandra, 2011).

Stock Exchange acts as an agent for the economy by facilitating trade and disseminating information. Hence, for these listed securities to be traded on Stock Exchange the companies are obliged to

disclose material information in a timely and accurate manner (Akinsulire, 2011). The disclosed material information must be done with precision and in order to enhance capital market efficiency the assessment of corporate information should be fair, timely and cost efficient as the company's obligation to stakeholders.

Therefore, the need arises for the listed companies to acquaint the regulatory information department of the stock exchange promptly of any change in the prices of the listed securities and the firm's financial position generally, this becomes imperative because the performance of the stock exchange to the stakeholders financial decision demands a swift, accurate and timely response.

### **CONCEPT OF BIG DATA**

The vast proliferation of data and increasing technological complexities continue to transform the way industries operate and compete. The upsurge in data inflow in the present era continues to transform the landscape of various sectors particularly financial services (Trevir, 2019). To tackle these challenges financial institutions are having a surge in embracing big data thereby gathering personal information; structured, semi-structured and unstructured data about individuals decision making through social media, emails and health records, applications, sensors and devices the investors use (Trevir, 2019; Rembert, 2020). The data that are stored in a relational database management system is given as an example of structured data while semi-structured data are data stored in an XML file however heterogeneous data source containing a combination of images, text files and videos, this can be stated as an output by Google search (Ellars, 2013; Rai, 2020).

Segal (2019) opined big data to be referred to as large, diverse sets of information that grow at ever increasing rates. Big data encapsulate the volume of information, the variety or scope of the data points being covered, Velocity or speed at which the data is mined, stored, analysed, shared and visualised. The veracity states the worthiness of the data and identification of possible bias, noise and abnormality within the data (Ellars, 2013). Warren, Moffitt and Byrnes (2015) expressed big data to be collection of data that is huge in

volume and yet grow exponentially with time. Segal (2019) stated further that this often comes from multiple sources and arrives in multiple formats. In substantiating this Trevir (2019) agreed that over the past few years 90 per cent of the data in the world has been created as a result of the creation of 2.5 quintillion bytes of data on a daily basis. This is commonly called big data which is captured as an asset due to its availability of source of information (Trevir, 2019; Sophie & Russell, 2018). Rembert (2020) stated the daily data to be absurdly large and accessibility and usability is made possible through big data.

Warren, Moffitt and Byrnes (2015) argued that 2020 will witness approximately 20-100 billions of connected devices leading to more data collection; thus illustrating a necessity for applying big data paradigm to business world. Minjian and Guangzhong (2017) affirmed that the research by the International Data Corporation indicates that the global data volume is expected to reach 35 zettabytes by 2020 and beyond that, the trend of growth doubling every 2 years will be maintained. Sarangam, (2021) asserted the current volume of data to be in Yottabytes, Exabytes and Zettabytes. Furthermore, in order to substantiate the assertion it was stated that 50 hours of videos are transferred on You Tube every moment; this implies that the era of big data has emerged. Meanwhile,  $10^{21}$  bytes is equivalent to 1 zettabytes or one billion terabytes forms a zettabyte (Minjian & Guangzhong, 2017; Sarangam, 2021)

Therefore, the imperativeness of big data in this information technology era in accounting industries are rapidly shifting with the economy as a whole toward a data driven market established in investigative abilities and correctness (Rembert, 2020). Warren, Moffitt and Byrnes (2015) asserted that data will have increasing and important implications for accounting and any financial institutions, even as new types of data become accessible. Improved stock exchange can be attained via big data due to information availability through video, sensor, audio, databases, spreadsheets, photos and textual information which can be structured or unstructured. Both profit oriented organizations and educational institutions explore the term big data analytics.

Baumann and Riedel (2020) identified that big data possesses unparalleled characteristics that makes both commercial application and academic researches emerge globally; vis-a-vis volume, organisation collect gigantic heterogeneous data from a variety of sources comprising business transactions, social media and information from sensor or machine to machine data. The stunning attribute of big data is the ability to process a voluminous data that normal conventional data analysing technique cannot handle. The volume of data to be stored in the past posed real problem but with the advent of technology such has been abated through the use of Hadoop. Hadoop is an Apache open source framework that possesses efficient data mining technique that is based on Java programming. This is widely used in supporting efficient storing and processing of massive data by allowing clustering multiple computers to analyse the datasets in parallel and at very high speed (Fadnavis & Tabhane, 2015). Rotsnarani and Mrutyunjaya (2015) opined that Hadoop runs applications using the Map Reduce algorithm that perform broad statistical analysis on enormous data. More so, the economic size of data plays very crucial role in determining value out of data which will be of great importance to Nigerian Stock Exchange. (Sarangam, 2021; Baumann & Riedel, 2020)

Baumann and Riedel (2020) stated velocity with regards to big data, as the speed of generating data, storing and analysing the same. Rai (2020) expressed that velocity basically denoted the speed at which data is being created in real-time in collaborating this, Trevir (2019) opined that fast data is generated and processed to meet the demands and determines real potential in the data. Trevir (2019) asserted that the New York stock captured 1 terabyte of information each day; this reveals the unprecedented rate at which data streams in. Another peculiarity of big data is velocity at which data flow in from sources like comments shared on social network, apps, websites, business processes, servers, application logs, networks and social media sites, sensors, mobile devices exchange.

In discussing variety, it is discovered that data streams in from different sources and array of forms of data; this is referred to as the variety of data collection. Data come in, in numbers,

texts, videos, images, audios, PDFs and emails, it is noteworthy that while in years past data come from spreadsheets and databases (Rai, 2020). Currently data comes from various raw formats and various sources (Segal, 2019).

Considering the veracity, Baumann and Riedel (2020) succinctly stated veracity to possess the ability to filter through the data to determine what is important and what is not. It is not just the quality of the data but how trustworthy the data is, the type, sources and processes. This peculiarity of big data filters the bias, duplications, inconsistencies, abnormalities and volatility in order to enhance the accuracy (Sarangam, 2021). The rapid growth and storage of data create opportunities for collection, processing and analysis of structured and unstructured and semi-structured data.

## **INFORMATION TECHNOLOGY IN STOCK EXCHANGE**

There is need for Nigerian Stock Exchange to bridge the gap between Information Technology and the business to remain universally competitive (Luke, 2020). Trevir (2019) stated that many financial institutions are adopting big data analytics in order to maintain a competitive edge. Adopting big data by stock exchange is to capture large volume of data and to increase the speed at which products gets to the trading floor in order to reduce the amount of time to the target audiences and to ensure that the stakeholders are satisfied (Segal, 2019).

Segal (2019) agreed that the big data is most often stored in computer databases and analysed using software specifically designed to handle growing, large and complex data sets which can be experienced at the stock exchange of any economic sector. It is obvious that the increasing volume of market data poses a big challenge to financial institutions. Along with vast historical data; banking industries and capital markets need to actively manage heavier data (Trevir, 2019). When it gets to performing efficiently and to be internationally competitive in the stock market using big data analytics could be the most effective weapon. Stock Market is one of the major financial areas that use analytical policies for competitive schemes. Anoop

(2019) asserted that big data analytics has helped online traders to make a very smart investment decision that would produce a consistent stream of revenues for the investors.

There is a rapid changing nature of the stock exchange which allows investors to access a large number of data through the use of mobile devices and social networks. The big data analytics help investors use the data with mathematical formulas with smart algorithmic trading (Anoop, 2019). According to Trevir (2019) this algorithmic trading has become synonymous with big data due to the growing capacities of computers. The automated process enables computer programs to execute financial trades at speeds and frequencies that a human trader cannot. Trevir (2019) added that within the mathematical models, algorithmic trading makes available trades executed at the optimal attainable prices and timely trade placement and lessens manual errors owing to behavioural features. Moreover, algorithms can be created with structured and unstructured data which is one of the peculiarities of big data. Incorporating real time news, social media and stock data in one algorithmic engine can generate better trading decisions (Trevir, 2019). Trevir (2019) further posited that unlike decision making, which can be influenced by varying sources of information, human emotion and bias, algorithmic trades are executed solely on financial models and data.

Anoop (2019) stated that in the past, the decisions were made based on the information on market trends and calculated risks. Now big data has made it possible to use a computer to feed an extensive amount of data so that traders can make up with the best online trading decisions. In the financial world, algorithm trading is one of the most significant trends going on at present. Machine learning enhances computers to analyse with very high speed. The real-time data produced by the big data provides a great potential to improve the overall investment decisions taken by individuals or online stock trading firms. By having access to the big data analytics, there will be mitigation against the probable risks on stock trading online and appropriate investments can be made. Therefore, through the aid of financial analytics which can be achieved through big data, principles that

affect trend, pricing and price behaviour can be established.

Anoop (2019) opined that the smart consideration of big data and machine learning provides opportunities for making decision centred on pure logic instead of using estimations and speculative mechanism. The data can be reviewed and application can be updated on time using the machine learning so that users would be able to correct decisions. It is possible for any individual stock trader or a large online trading giant; anyone can leverage the big data analytics to give a serious positive boost to make stock investment decisions. Many financial institutions are adopting big data analytics in order to maintain a competitive verge. Trevir (2019) stated that through structured and unstructured data, complex algorithms can execute trade using a number of data sources by the stock exchange. Hence, human emotion and bias can be minimised through automation. The rapid growth and storage creates opportunities for collection, processing and analysis of structured, semi-structured and unstructured data in all spheres of life.

Stock market process is full of uncertainty and is affected by many factors. Traditionally number crunching was done by humans and decisions were made based on inferences drawn from calculated risks and trends (Lima, Portela, Santos, Abelha & Machado, 2015). However in recent times such functionally is usurped by computer. As a result, the market for big data technology in finance offers great potential and is one of the most promising models. Avaniidhar (2019) specified that in conjunction with big data, algorithmic trading is thus resulting in highly optimising insights for traders to maximise portfolio returns.

### **NEED FOR TRANSFORMING THE TRADITIONAL ANALYTICS TO BIG DATA ANALYTICS**

The economic industry in the 21<sup>st</sup> century is highly dependent on data; due to the enormous effects and benefits of big data that accrue across the global industries, big data has become the business language with regards to information system because of the unprecedented volume of data created in the millennium. Therefore, Trevir (2019) reasoned out that the financial institutions can break

edge by focusing on effective and quick method of processing trades through the adoption of big data which will inevitably transform the landscape of financial services competitively.

Kevin (2016) is of the opinion that there is need to bridge the gap between traditional mode of analysing data with the current trends of emerging better business models in order to flow with the tide of globalization and remain competitive. Engaging the four Vs vis-à-vis velocity, veracity, variety, and volume dimensions of big data organisation use data and analytics to gain valuable insight to inform better economic business decisions (Trevir, 2019). Therefore, embracing systematic processing and analysis of data is the underlining factor. Large and complex data grow exponentially that none of the traditional data management tools are able to store or process the data efficiently and effectively, worthy of note is that, this can be handled by big data analytics. Following the trend of events all facets of life are being transformed by the impact of big data and data analytics, then the role of accounting and finance professionals is set to change too (Luke, 2020). There is need for accounting and finance professional to bridge the gap between the Information Technology department and the business (Luke, 2020).

Luke (2020) state that about 90% of the data in the world today has been created in the last two years alone, hence there is access to unprecedented pool of heterogeneous volumes of data and because of increasing ability to analyse and gain new perceptions from it, big data presents a unique opportunity for businesses to use for strategic advantage. This opportunity brings about increase operating effectiveness; assess risks, ability to filter, identify advantages and weaknesses through analysis by big data (Luke, 2020). Big data has huge importance to the business because of the ability to give shrewd businesses edge over the competitors. Luke (2020) asserted that the era of spreadsheet is becoming obsolete in the current globalization more so, that before the advent of big data paradigm, finance and accounting discipline analyse the profitability and returns in investment which are just structured information (spreadsheet) but in this technological era, semi – structured and

unstructured data have enriched traditional finance and accounting data.

The ability to use big data analysis tools to gain insights about business issues such as, details about customers, maximization of computing power and algorithmic accuracy in comparing enormous data is really gaining ground. Big data can offer accountants and finance professionals the possibility of reinvention, the chance to take a more strategic “future - facing” role in organizations (Luke, 2020). The capability of any organization in forecasting and averting either systematic or unsystematic risks in the future events are the major advantages at any company’s disposal. Big data comes up with huge power, not only by the ability of processes large amounts and variety of data at high velocity, but also by the capability to create value to organization.

### **Challenges**

Despite the financial services industry increasing embrace of big data, significant challenges still exist in the field. Most importantly, the collection of various unstructured data supports concerns over privacy. Personal Information can be gathered about an individual’s decision making through social media, emails and health records, sensors machine – to – machine data. Within financial services specifically, the majority of criticism falls unto data analysis. The sheer volume of data requires greater sophistication of statistical techniques talking of data in quintillion bytes in order to obtain accurate results. In particular, critics overrate signal to noise as patterns of spurious correlations, representing statistically robust results purely by chance. Likewise, algorithms based on economic theory typically point to long – term investment opportunities due to trends in historical data. Efficiently producing results supporting a short – term investment strategy are inherent challenges in predictive models.

In the past, storing the data would have been a problem but new technologies such as Hadoop have eased the burden. Growing reliability of live datasets create challenges for traditional analytics as the data are growing in exponential rate and steadily (Rembert, 2020)

## CONCLUSION

The contemporary time has witness the growth of data, bringing big data to fore. Therefore, the availability of big data has prompted interest amongst accounting and finance academics. Big data has greater potential to bring in novel datasets to bear in different patterns on the field of investment management than small data. Subsequently this has enticed much consideration because of the outstanding benefit of it possesses; decision making, customer insights and fraud detection and prevention. For financial institutions, big data analytics represents an opportunity for expansion and it provides insights for great valuable services above peers in the economy. Embracing the big data paradigm give an edge to soar above obsolescence and be competitive globally and possess predictive capability. Rembert (2020) recognized that the power of big data lies in its ability to reveal trends and patterns in business and human behaviour that are difficult to realise with smaller data sets since it is typically of big data to measure in petabytes, terabytes or zettabytes of data which is stated to be far beyond the scope of any human organization to actually analyse.

The objective of big data is to increase the speed at which products get to market or the trading floor for adequate dissemination of information to reduce the amount of time and resources required to gain market adoption, target audiences and to ensure customers undaunted satisfaction (Segal, 2019). Lima, Portela, Santos, Abelha & Machado (2015) asserted that Big data is appropriate for all organizations with huge business data due to its ability to accommodate and analyse structured, semi structured and unstructured data at a very high speed. Avaniidhar (2019) stated that traditionally number crunching peculiarity of stock exchange was done by humans and decisions were made based on inferences drawn from calculated risks and trends. However, in recent times such functionality is usurped by computer. As a result, the market for Big Data technology in accounting and finance offers unparalleled potential and is one of the most promising models. Big data can be analysed for perceptions that leads to better decisions and strategic business move.

The following recommendations were made:

1. Advances in analytics and computing have made it possible for financial experts to analyse data vis-à-vis structured, unstructured and semi-structured data that could not be analysed some period past. Dates past, computers were employed on analysing structured data that could be easily quantified, organized or positioned in a set way. Currently, globalization is harnessing technology in all facets of life for better efficiency and competitiveness. Therefore, the Nigerian Stock Exchange should embrace the big data analytics for better adeptness and global competitiveness.
2. Diverse forms of data are streaming into financial sectors at a high velocity and volume and the expected results are needed at an alarming rate. The new technologies should be employed by all financial institutions for effective analysis of data that are not easily quantifiable because this enables the markets to embrace emerging issues technologically and also possess the capability to interpret information from a variety of sources, including sensors, emails, images, languages, speech and any form of social media handles.
3. The government should recognise the effect of globalization and the information dynamism which will make any economic sector or institution obsolete if trends are not followed. It is imperative to adopt the paradigm seeing that big data provides access to unique types of data, coupled with the ability to gather and analysed the data quickly. The analytics has transformed how the markets operate and evaluate investment and the profitability level in real-time for economic growth.
4. Big data has changed the landscape of many industries especially financial industries. Therefore the financial regulatory bodies should embrace big data analytics to solve complex

algorithm that can be used to execute trades using a number of data sources. This can aid in curtailing human emotion and prejudice through automation.

5. Stock exchange can maximise the technological calculation power and algorithm accuracy together, evaluate, associate and compare huge data sets. The use of big data is employed universally because many financial institutions are using big data to mitigate operational risk and war against economic fraud while significantly easing information asymmetry complications and attaining regulatory and compliance goals.

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