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DATA ANALYTICS IN ADVANCING ACCOUNTING PROFESSION AND BUSINESS INFORMATION FOR DECISION MAKING

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ABSTRACT

The nature of the risks and opportunities facing business has changed over time. Much of the global value today is more of technology service and knowledge based than it was 40 years ago. The study examines data analytics in advancing accounting profession and business information for decision making. Two specific objectives guided the study, the study used a survey research design approach, and the population consists of 300 respondents made up of 50 each from academics, financial analysts, accountants, business owners, investors and big data analysts. Descriptive statistics was used to analyses the data while Z test was used to test the hypotheses. The findings from the study shows that the two hypotheses tested has a high acceptance degrees level of an average percentage of (92.4%) and (86.98%) respectively, this goes to shows that the issue of big data analytics in advancing accounting profession and business information for decision making is very much germen. This also was observed in the results of Z-Test of the Standard Deviation of (0.412) and (0.303) respectively, which leads to the acceptance of the two alternatives hypotheses and rejecting of the null hypotheses. The study concluded that big data analytics improves and help business organizations take informed decisions to enhance their operational efficiency, also, that the world accepted the slogan that data is the new oil. Those who are able to gain out of that will remain in the business ie, survival of the fittest. This is the implication to the new millennium environment where the professional accountant finds itself. Therefore, should be able to deal with the complex procedures, so that the accountant will be a big data analytics professional too. The study recommended among others that all the stakeholders (academics, financial analysts, professional association bodies, accountants, business owners, investors and government) should be involves in the necessity of teaching big data and business analyses in management sciences in our higher institutions to promote students' knowledge, the continues enlightenment, holding workshops, training and retraining courses for researchers and academics of the importance of analyzing big data and how to process, store, manage and use the analyzed data in the financial and accounting field, since using big data can lead to better disclosure which in turn enhance investor trust.

KEYWORDS Data Analytics, Accounting Profession, Business Owners, Information, Decision Making.



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1.0. INTRODUCTION

The developments in the information and communication technologies allow that datasets become more accessible. New types of data arise such as real-time contents and the big data analytics (BDA) that help to solve issues between users and preparers of financial reporting and accounting (Yuri 2014). (Yoon, Hoogduin & Zhang 2015) added that data analytics bridges information technology, statistics and business. It enables increased efficiency and improved performance by discovering patterns in data. The focus of data analytics lies in inference. (Wong 2017) affirm that it is a process of examining raw data to derive certain conclusions. (Warren, Moffitt & Paul 2015) in their view stated that data analytics is a broad term that encompasses many diverse techniques and processes of drawing insights from historical data over time. (Verma 2016) emphasize that today the term data analytics is most often used to describe the analysis of large volumes of data and/or high-velocity data, which presents unique computational and data-handling challenges. Further to this big data is nothing but dealing with huge data and extracting the needed information from it (Venkatesh 2018). The big data can be explained with the help of 3V: Volume - huge amount of data; Variety - data will be mixed with text, image, audio and video files; Velocity - the high speed with which data is created. (Vasarhelyi, Kogan & Tuttle 2015) opined that due to the complexity of handling and dealing with the big data organization should device a sophisticated processes to extract the needed information from such big data and making them available for decision making. (Tysiac 2019) described the process used as data mining which accounting professional and business owners need in this contemporary era.

Tykheev (2018); Hsin-Yu (2020) emphasized that accounting profession and business owners are in recent years in deer need of techniques and models of handling such numerous huge big data they have to deals with on daily basis from time to time. Accounting as a discipline in this era cannot be imagined deprived of the sustenance provided by this modern techniques and models in accounting technology in solving present day problems (Ehioghiren & Ojeaga 2022). Nagat (2020) added that the ability to mine data is constantly improving. But companies that are familiar with their own data can present it in meaningful ways that provides investors with information that can be used to tell their story. The study of (Coyne, Coyne & Walker 2018) has analyzed the role of accountants in the era of big data. Although big data has become clearer for accounting, but accountants have little understanding of turning such data into useful information. As a result, there has been a gap between what accountants can and should do to help in big data governance. Therefore, accountants had to play a key role in managing and analyzing big data because they have a great ability to determine decision-makers' needs. (Sanchez 2019) agree that there is uncertainty among accountants about how to incorporate big data within their firms or how to determine which steps to take when crafting an effective analytics strategy. He indicated five main tips to accountants on actions to take when utilizing big data which includes; focusing on outliers and unexpected patterns; create visuals that emphasize insights; anticipate initial costs for investment into big data; prioritize cyber security and make sure you have the right team from accountants who can analyze the big data you possess.

(Taylor 2017) added that we lived in a connected world, where loads of data is being generated every second. With digitization and growth of internet, the data to be dealt with has become not only humongous, but it is getting generated at a pace which is unimaginable and coming from innumerable sources. This data is aptly called as 'Big Data' which uses advanced analytical techniques, aims to provide valuable insights to facilitate decision making by impacting human existence as it has entered into various fields.(Schmidt, Riley & Swanson 2020)

The term big data can have different definitions as stated by (Sperkova, Vencovsky & Bruckner 2014). As different stakeholders look at big data from a varied range of perspectives; it is not easy to have a precise definition (Sharma 2017). However, in a broad sense, big data can be defined as large data sets that require super computers to collate process and analyze to draw meaningful conclusions (Thornton 2014). (Richins, Stapleton, Stratopoulos & Wong 2017) added that perhaps Francis Diebold was perhaps the first to use the term 'Big Data' in 2003 for the current phenomenon or explosive growth of data. He stated that "Recently much good science, whether physical, biological, or social, has been forced to confront and has often benefited from the big data phenomenon. Moore & Felo (2021) emphasizes that big data is the explosion in the quantity and quality of available and potentially relevant data, that will guarantee the result of recent and unprecedented advancements in data recording and storage technology.

Decision-making is an integral part of the functioning of an organization. A number of decisions are required to be taken by managers from time to time (Shastri & Rajpurohit 2017). The process of decision making starts with the identification of a problem. The next step is to search for alternatives to solve the problem (Schneider, Dai, Janvrin, Ajayi & Raschke 2015). Now, some information is required, to evaluate the relative worth of the alternatives so that the best one is selected for action (Princy 2018).

Some basic data in the form of facts, figures, numbers etc. is collected, which when analyzed and put into some context is termed as information. Even for the smallest of problems, we require a little information to proceed with (Hsin-Yu 2020). The bigger the problem, the bigger will be the decision, having bigger implications, and bigger will be the data which is to be collected. (Murthy & Geerts 2017) assert that the 'Big Data' thus, has a crucial role to reevaluate the efficiency of businesses daily work in decision making. Against this backdrop the study attempts to examine data analytics in advancing accounting profession and business information for decision making by considering these specific objectives; (1) To ascertain using financial accounting information big data will lead to better disclosure that enhance investor trust. (2) To ascertain using big data will help in refining existing accounting standards and developing the needed ones.

2.0. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Overview of Data Analytics

Big data analytics plays an intriguing role in making business and accounting professional succeed, from business evaluation performances, financial performance management, advanced forecasting, to fraud and forensics (Andiola, Masters & Norman 2020). Data analytics makes the switch from the traditional business recoding and processing, accounting, auditing process into continuous real time business operations and auditing by making the software to do the retroactive and repetitive work. Previously, business operations and auditors had to manually input the data to generate monthly, semi-annual, or annual reports for the business and clients, which was inefficient (Arvind 2019). Ratio, trend, and regression analysis and more are the basic statistical techniques used in a traditional business and auditing process. Also, data modeling in business and accounting profession has not helps only efficiency but also enhances transparency between the transactions and information sharing between the users, stakeholders for decision making. (Bansal, Batra & Jain 2018) added that the data perceivable helps the owners, employees and professional to improve their analytical skills as well as improved their decision making ability. The premise to this is that owners and accountants have technical skills to run large sets of data with statistical analysis tool. Further to this, organization

keeps making effort in educating the decision makers to be familiar with the models used in the accounting and business industry (Hsin-Yu 2020).

What is Big Data?

The most widely used definition of Big Data is given by (Griffin & Wright 2015): “Big Data is high-volume, high velocity and/or high variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making and process automation.” Big Data involves huge and complex data volumes that are beyond the capacity of traditional data processing applications.

Griffin & Wright’s definition has emphasized on three important and distinct features of Big Data which are known as three Vs:

- i. Volume: Big data involves large amounts of data with sizes of terabytes and zeta bytes. Which mean that the data generated, stored and used are much more than what it was earlier?
- ii. Velocity: The speed at which data is coming and getting refreshed is enormous. Often, the time frame to act on the basis of these data streams is very short. One can use data on a real time basis through mobile telephony, CCTVs, online transactions etc. Therefore, the speed of data generation is tremendous.
- iii. Variety: Data is coming or generated from multiple sources apart from the conventional data sources, both internal and external and in various formats such as structured, semi-structured and unstructured. For example social media is an important source of data generation and used for different purposes.

There are 3 other Vs of Big Data namely Variability, Veracity and Value, which when added to Griffin & Wright’s 3 Vs, gives us 6 Vs of Big Data (Hagel 2013).

- iv. Variability: With sequential and multi-dimensional data there can be substantial variance at different sub-set levels
- v. Veracity/Validity: Multiple data sources along with mechanization of data capturing, resulted in increased authenticity of data
- vi. Value: As there are multiple users of the same data sets, it is worthwhile to capture and store the huge data.

Dave (2021) added that basically Big Data is a collection of very large and complex data sets which are not possible to process with traditional data processing applications. Some experts believe that it is a combination of different ‘V’s

- vii. Venue: There are several data sources and data warehouses with different purposes and different formats.
- viii. Vocabulary: There are newer definitions, terms and concepts used at present compared to those used earlier.
- ix. Vagueness: The new terms and definitions are also creating confusion about the meaning of big data

Big Data Analytics

Big data analytics (BDA) is the complex process of examining large and varied data set- or Big Data- to uncover information including hidden patterns, unknown correlations, market trends and customer preferences that can help organizations make informed decisions (Earley 2015).

BDA is driven by specialized analytics systems and software, as well as high-powered computing systems, and offers various business benefits including revenue opportunities, effective marketing, better customer service, improved operational efficiency and competitive advantage (Cockcroft & Mark 2018).

BDA deal with big data of varied nature which can be broadly categorized as follows:

Structured Data Sets

Any data that can be stored, accessed and processed in the form of fixed format is termed as a 'structured' data. It can be used in its original form to derive results. Examples include employee salary records, phone numbers, product names and numbers etc (Fanning & Grant 2013).

Unstructured Data Sets

This type of data is without any proper formatting and alignment. Examples include texts files, search results, images, videos etc. It will require more processing power and time for conversion into structured data to derive some results.

Semi Structured Data Sets

These are the combination of both structured and unstructured data. These data sets might have a proper structure and yet lack defining element for sorting and processing. Example is data presented in an XML file.

Big Data Analytics Technologies and Tools

There are many open sources of big data tools for big data processing. (Blix, Edmonds & Sorensen 2021) mentions some important of the big data tools:

- a) Hadoop: is an open-source software framework which can process large data sets. It allows distributed processing of large data sets across clusters of computers. It is designed to scale up from single servers to thousands of machines. Furthermore, it can run on a cloud infrastructure.
- b) Apache Spark: this is a powerful open source big data analytics tool. It offers over 80 high-level operators that make it easy to build parallel apps. It is used at a wide range of organizations to process large datasets. It handles both batch data and real-time data.
- c) Apache Storm: is a free and open source big data computation system which provides real-time stream data processing instead of batch data processing.
- d) Apache Cassandra: this is a distributed type database to manage a large set of data across the servers to process structured data sets. It does not follow master-slave architecture, and all nodes play the same role. It can handle numerous concurrent users
- e) Microsoft HD Insight: HD Insight is a Spark and Hadoop service in the cloud. It provides an enterprise-scale cluster for the organization to run their big data workloads.
- f) Tableau Public: It offers intriguing insights through data visualization, which can be embedded into blogs and shared through email or social media, which can be made available for downloads.

Type and Sources of Data:

Based on the type data can be categorized into structured and unstructured data. It is the structured data we mostly encounter. This type of data is written in a format that's easy for machines to understand. Examples include spreadsheets and data from machine sensors. Structured data easily fits into traditional relational into relational databases like SQL, ORACLE etc and can be easily searchable by basic algorithms.

Big data mostly consist of unstructured data which is generated from human as well as machine source (Kaya & Akbulut 2018):

i. Human-generated unstructured data

Unstructured data is more like human language. Examples includes: (a)Text files (b)emails, (c) Social Media posts like Facebook, Twitter , audio files, and images etc, (d)websites videos like YouTube, Instagram etc, (e) Mobile data like text messages, locations etc, (f) Communications like chat, IM, phone recordings etc, (g) Media like mp3, digital photos, audio and video files etc, and (h) Business applications like MS Office documents (Word docs, PDFs, etc.), productivity applications etc (Taylor 2017). Processing and searching such data based on the old algorithms ranges is difficult to completely or impossible.

ii. Machine-generated unstructured data

These includes; (a) satellite imagery like weather data, land forms, military movements etc, (b) Scientific data like Oil and gas exploration, space exploration, seismic imagery, atmospheric data etc, (c) Digital surveillance and (d) Sensor data like Traffic, weather, oceanographic sensors etc (Bernard 2015).

Application of Big Data in Real Life

We are living in an era where almost every aspect of our life is digitized. Technological progress has ensured that the huge volume of data that is getting generated every second is duly captured and is accessible at ease. Big data analytics offers an ocean of opportunities in any sphere of activity (Breur 2015). It has already made its presence felt in sectors like education, healthcare, media etc.

1. Education Sector

A huge amount of data relating to students, faculties, courses, results etc. is generated in the education sector. A proper study and analysis of this data can provide insights that can be used to improve the operational effectiveness and working of educational institute. It may provide insights in designing customized and Dynamic Learning programmes, reframing of Course Materials, career prediction (Barutçu 2017).

2. Healthcare

Over the past decade, Big Data has been very useful in the healthcare industry. Electronic Health Records (EHR) are being widely adopted in hospitals and clinics worldwide. There is reduction in costs of treatment by avoiding unnecessary diagnosis. It helps in predicting outbreaks of epidemics and in deciding what preventive measures could be taken to minimize the effects of the same. Wearable devices and sensors can provide real time feed to the electronic health record of a patient (Nagat 2020).

3. Government

Big Data analytics helps government in planning and implementing various welfare schemes. Examples of data-driven policies are Demonetization and GST implementation in 2016 and 2017 respectively. In 2017, the Indian government launched Project Insight, a platform completely based on Big Data Analytics, which analyzed data to catch tax evaders (Richardson & Watson 2021).

4. Sports

Many Sports organizations are adopting data-driven decision-making strategy from player recruitment to fan engagement, which has led to increased investment in data analytical solutions. ‘Money-ball’, the 2011 Hollywood movie described the real story of how Oakland Athletics manager Billy Beane used analytics to achieve success in Major League Baseball. Andy Flower, the former England cricket coach, possibly executed the most noticeable and successful application of the ‘Money-ball’ philosophy in cricket (Atanu 2018).

5. Media and Entertainment

There is a rise in Big Data in media and entertainment industry mainly because of availability of digital content and increased use of smart phones. Social media platforms are also contributing to Big Data (Barutçu 2017). It helps in predicting the interests of audiences, optimized or on-demand scheduling of media streams in digital platforms, getting insights into customers’ reviews. Moreover, advertisements can be targeted more effectively.

6. Weather Patterns

Weather sensors and satellites are deployed around the globe which collect huge amount of data which is used to monitor weather and environmental conditions. This data can be used in different ways such as weather forecast, study of global warming, understanding patterns of natural disasters, and preparations in case of a crisis (Prokopowicz & Gwozdziwicz 2017).

7. Transportation

Big Data Analytics can be used for efficient route planning by understanding and estimating users’ needs on different routes and on multiple modes of transportation to reduce waiting times. Real time traffic data helps in congestion management and Traffic control. Accident prone areas can be identified to help reduce accidents and increase the safety level (Tysiac 2019).

8. Banking

Millions of transactions are recorded in real time by banks every day. Analysis of this data can help detect illegal activities like misuse of credit cards/ debit cards, fraudulent transactions, customer statistics alteration, money laundering etc. With a huge volume of data created from countless transactions, the banks can find out innovative business ideas and risk management solutions (Schmidt, Riley & Swanson 2020).

9. Social Sector

Insights gained from Big Data can play a crucial role for social good. In February 2017, Telefónica, a Spanish Telecom company collaborated with UNICEF on its Magic Box initiative- a social good platform which collects real-time data, combining and analysing aggregated and anonymised data from private sector companies. This helps UNICEF in optimising its response to public health emergencies and natural disasters protecting children and saving lives (Maurer, 2020).

Traditional Verse Business and Professional Audits services in Big Data

Krahel & Titera (2015) recognizes the advances in the management of statistical science and data set and how transformational applications change the auditing process by comparing the differences between the traditional audits and the professional audits. With the software and the auditor’s

capability to analyze entire sets of translation rather than a sample, the outliers are more quickly and accurately identified (3). With the help of big data applied in auditing practice, accountants now move from doing repetitive accounting tasks to creating financial plans and offering insights to their clients, that help with the job's efficiency and increase the competitiveness between accountants because they offer advice that is more specific to the clients need.

	Traditional Audits Needs	Future Audits Needs
Type of Data	Quantitative and Structured	Unstructured and semi-structured
Frequency	Periodic	Continuous
Approach	Reactive	Proactive
Procedure	Manual and analytical review	Automatic and continuous controls
Nature	Time intensive labour	Handling exceptions
Internal	Independent role	Collaborative
External	Independent	Certifier of the auditing system
Testing	Humans perform sample testing	Models monitors entire population
Reporting	Periodic	Continuous

Why data analytics matters to the accounting profession

The accounting profession is not what it was twenty years ago. Accounting software automates the data entry process, links various accounts, and generate reports on demand instantly. The accountant's role increasingly is about interpreting data, helping business refocusing and reducing inefficiency (Margaret 2018). Modern tools, such as Tableau, Excel, and IDEA, enable data exploration that helps auditors focus on high-risk areas. Auditors also employ continuous monitoring by analyzing and verifying large data sets (Dave, 2021). Data analytics as of today is helping tax accountants analyze investment scenarios in complex taxation situation.

Big Data Analytics and the Future of Auditors

Auditing is the most sought after course everywhere in the world. Auditing means checking the accuracy of books of accounts and comment that whether it is giving a true and fair view of the business or not. But apart from that, auditing is expanded to many other areas. The auditing personnel are upgraded into a role of managerial personnel. Auditing is now one of the glamour professions that one can have. Actually auditing has a serious drawback that it is more depended on test checking. Because using the present methods, an auditor will not be able to check those huge data which is having the 3Vs (volume, variety, velocity). So big data analytics can solve this too a great extent by using sophisticated technologies and processes like data mining. So auditing will become a false proof method.

The question arises here is whether the introduction of big data analytics into auditing will lead to the extinction of auditors or not. The answer is not so easy. However it is true that auditors still have a

vital role to play. The role will be as of an administrator. But it will lead to extinction of such professionals who are reluctant to change. Even though, the technology at the tip of everyone, still big data analytics is a hard nut to crack. So the new millennium auditor should be an analytics professional too. Otherwise he will be out of the market, because survival of the fittest is the slogan of the market. If big data analytics included in auditing, the entire process will become a false proof one.

Role of Big Data in Auditing

Big Data can transform auditing research (Griffin et.al 2015). Sufficient, relevant and reliable information obtained from Big Data can complement traditional audit evidence as Big Data is often externally generated and can be collected directly by the auditor. For example to verify the shipments, auditor can use global positioning system (GPS) data obtained directly from a shipper rather than relying on client-provided shipping documents. Social media posts can be mined to gauge customer sentiments regarding products, which could serve as useful inputs into analytical procedure models designed to estimate whether sales revenues are within expected bounds. (Yoon et. al 2015).

(Vasarhelyi et.al 2015) stated that “because of the large number of additional forms of evidence, their highly probabilistic nature, and the progressively more and more automated audit systems, it will be necessary to create a formal method of evidence aggregation. This raises important questions for future research including:

- (1) What models can be used?
- (2) What will be the algorithms of prioritization?
- (3) Can Big Data bridges be used to enrich the above forms of evidence?”

The below table illustrates uses of extended audit evidences. For example web hits is an externally generated evidence which can be used to predict future revenues, purchases, cost of sales, profitability, geographical performance, project appraisal etc. with higher levels of accuracy than ever before with the help of Big Data analysis

Tang & Khondkar (2017b) summarized the benefit of big data to the auditing sector;

- a) Auditor can deal with any amount of data irrespective of its size
- b) Auditors can extract the real value from the raw data
- c) Auditing will become a false proof method
- d) It enhances the integrity of auditing profession
- e) Reduces human errors and personal bias

Drawbacks of Big Data Analytics in Auditing

1. Lack of experienced professionals in the country
2. Reluctant to change attitude If the auditor is not able to control the system, auditing will be an utter failure
3. There is issues of data privacy chances of auditor becoming a slave of technology

Role of Big Data in Financial Accounting:

For marketing and other functions, firms are already using Big Data and they are finding its contribution as a valuable one, however since such Big Data is not integrated with traditional accounting and enterprise resource planning (ERP) systems, these accounting systems are facing a danger of becoming obsolete. (Moffitt & Vasarhelyi 2013) agree that the advent of Big Data is going to have impact on various aspects of accounting and auditing e.g.

- Assurance procedures
- Accounting measurement and representation methods
- Incorporation of semantic data from multiple sources and semantic understanding of accounting-related phenomena
- Formalization of accounting-related procedures, standards and explicit consideration of digital information provisioning
- Economics associated with the adoption of new accounting and auditing processes such as issues related to education of accounting and social welfare.

“While the applications of Big Data and analytic techniques for business purposes have received considerable attention, it is less clear how external sources of Big Data relate to the transaction processing-oriented world of accounting information systems” (Murthy et.al 2017)

As new types of data like textual, audio and video information is made available through Big Data, it will have increasingly significant implications for accounting leading to improved financial accounting and reporting practices. Transparency and shareholder decision making will be improved as the quality and relevance of accounting information will be enhanced due to use of Big Data. (Warren, et.al 2015)

Textual data include nonfinancial or soft documentation. Some important repositories of text are SEC filings, emails, web pages (including corporate documents found on company websites), news media, and social media. One of the largest and fastest-growing repositories of relevant textual data is Social media. For example, the number of Facebook participants, Twitter users, and public blogs as of 2013 was 700 million, 250 million, and 156 million, respectively (Tan, Ji, Lim, & Tseng 2017). This number has today tuned out to be 1.52 billion daily active users for facebook, 275 monthly active users (Tang & Khondkar2017b).

Data from these sources will be helpful for the firm to recognize the key areas and also over the areas that need improvement.

Audio data (quarterly conference calls, shareholder and board of directors’ meetings, customer calls, internal employee phone calls, microphones placed on company premises for surveillance, and audio from video sources) related to business activities if captured and analysed properly can improve the quality of financial and accounting information. (Warren et. al 2015). For example review of already recorded audio or video of previous meetings can be helpful for decision making in the next meeting not only for analyzing past variances but also for setting the future agenda. “Interview video data, combined with vocalic and linguistic elements, creates a more complete picture of executive intent and potentially gives insights about a company’s health. To collect interview data efficiently, the process could be automated.” (Prokopowicz & Gwozdziejewicz 2017). Video data could be a valuable source of vital financial and accounting information e.g. nonverbal components derived out of video recorded interviews of management and board of directors can be more valuable and relevant than the verbal content.” (Shastri, Wadhwa & Rampal 2018).

“Similar to video data, the methods can also trace down business images from images including objects and scenes that appear in company-related images uploaded by customers, the demographic breakdown of product users featured in those images, and the condition and use of company products found in images. Image analyses could generate useful business insights, including but not limited to knowledge concerning product usage tendencies, and accurate assessments of corporate image.” (Sperkova, Vencovsky & Bruckner 2015). For example if a customer of a hotel posts the picture of a

fountain then it shows that the fountain fascinates the customer. Thus image analysis may guide the management about key focus areas.

Traditional financial information augmented by different forms of Big Data such as video, images, audio, and text has potential to improve transparency. Using Big Data technologies, it possible to detect irregularities like outliers, thus ensuring management, auditors and other stakeholders. This can also facilitate better decision making.

(Shastri, Wadhwa & Rampal 2018) stated that “companies with fuller disclosure win more trust from investors e.g. found that mandatory cost audit enhances investor trust. But it has the potential to do so directly if investors are educated about cost audit and its reports are made public through innovation in reporting mechanism. Thus the more the disclosure, the higher is the trust of investors. Since accounting system using Big Data also brings better disclosure and transparency, it is likely to improve investor trust.

Big Data can transform accounting research (Sicular 2013). (Murthy et. al 2017) used the five-phase Resource-Event-Agent Enterprise Ontology (REA) based specification of a business transaction as defined in ISO (2007) to model the implications of external Big Data sources on business transactions. Several information extraction patterns are specified for extracting business transaction-related information from Big Data using technologies such as Map Reduce and Apache Hadoop. They demonstrated that better decision making is possible due to integration of specific external Big Data sources with traditional transactional data through presenting various analytical patterns.

Role of Big Data in Management Accounting:

From the early 20th century, accountants contributed a lot toward their firms’ strategic decision-making through engaging in a problem-driven approach applied on structured data largely using DuPont Analysis framework, but now in modern times’ business environment generating Big Data, there exists a need to shift from DuPont framework to a new framework for upcoming future (Wong 2017).

One such attempt was made by (Breur 2015) who used structured and unstructured data (textual information from firm disclosures about major customers) to test the hypothesized negative relationship between customer base concentration and firm performance and he found that, although the relationship between customer base concentration and gross margin is negative, the effect on net income is positive because general admin and marketing overheads reduces.

In information economy, many organisations are leaving traditional methods because of their inward focus and adopting so called beyond budgeting techniques (Bhimani & Willcocks 2014). Alternative sources of information for strategy formation, goal communication, operational planning and performance evaluation, are used in beyond budgeting, (e.g., climate, satellite, census, labor, and macroeconomic data) will play a very important role in evolution of effective budgeting processes, as it will facilitate adoption of beyond budgeting practices (Warren et.al 2015). This will promote use of alternative sources of information for planning and performance evaluation.

Management accounting presents analysis of information generated from accounting records so as to facilitate managers carry out their duties. One of the pivotal duties of a management accountant, at the helm of affairs of any firm, is to create systems, so as to facilitate goal congruence i.e. alignment of organizational goals with the behaviours of management and employees through behaviour regulating

devices collectively known as the Management Control Systems (MCS). One of the most popular MCS tool is Balanced Score Card (BCS) (Sperkova, Vencovsky & Bruckner 2015). This system identifies financial and non financial measures for behaviours that best fit with business objectives.(Sperkova et.al 2015).

Big Data affects the design and operation of management control systems (Griffin et. al 2015).The availability of image files, audio, video and non transactional textual data (e.g., email messages) through Big Data will lead to better management accounting practices as it will play a significant role in the development and evolution of effective management control systems. (Warren, et.al 2015)

“Big Data can play a role in MCSs by discovering behaviors correlated with specific goal outcomes, which would prompt the creation of corresponding performance measures. For example, the BSC collects data in four areas: financial, customer, internal business process, and learning and growth. Within each area, Big Data can identify new behaviors that influence respective goal outcomes. For instance, web use while at work may be tied to learning and growth goals, internal emails may correlate with the effectiveness of internal business processes as well as customer service quality, and customer service quality may be related to vocalic cues mined from customer service calls.

In general, Big Data analyses can facilitate the discovery of important measures to be incorporated in MCSs. Companies can use metadata, such as the amount of time spent on a telephone, to track productivity. In sales, greater phone use might indicate higher productivity, whereas the converse could be true in manufacturing. Employee computers can also be monitored to generate activity logs that contain data on web use, click streams, and time spent using productivity software such as MS Excel. Companies can also monitor employee telephone calls, emails, and in-office behaviors.

Furthermore, companies can track what employees do with company resources away from the office including vehicles, cell phones, and P-Cards. Big Data could convert MCSs into comprehensive monitoring and control systems (CMCSs)” (Warren, et.al 2015)

From the above discussion it is evident that Big Data in MCS has a micro focus on various aspects including human resource management, which is not only important for organizations looking for standalone growth but also for inorganic growth e.g. it is very important to bring coordination in HR issues even for better synergy in Mergers and Acquisitions (Shastri et.al 2014). Employee engagement, which is one of the important HR issues, has a significant positive impact on firm value (Shastri et.al 2017). Use of technology is important in engaging millennial employees (Shastri et.al 2018).

Thus it can be inferred that Big Data through CMCS can play a vital role in enhancing employee engagement levels and thereby enhancing firm value through establishing superior HR practices, and it is vital, as inferior HR and ethical practices may even lead to corporate frauds(Mittal & Shastri 2018).

“India is likely to have the world’s largest workforce by 2027, with a billion people aged between 15 and 64” (Sharma 2017). Thus Millennia’s are going to form substantial proportion of workforce in growing economies around the world.

Millennia’s have grown up with internet, smartphones, laptops, real-time media and communications channels and various social media platforms. This also lowers their level of patience and at the same

time make them expect immediate feedback from their managers. They are uncomfortable with rigid corporate structures and dislike information silos. MCS based on traditional information sources may create a Skill gap for such Millennials. Skill gap is not only harmful for career prospects of the employee but also create hindrances for firm performance, value and growth (Shastri et.al 2018). Cashless system helps in bridging the skill gap.

Implications of Big Data Analytics on Accounting Professionals:

Big data analytics offer accounting professionals an opportunity to increase their visibility and weightage in business. (Tang & Khondkar 2017a) stated that the impact of Big Data Analytics on Accounting Professionals may be elaborated with the following points:

1. Acquiring Technical Competencies:

Accounting professionals should be trained in software tools such as XBRL (eXtensible Business Reporting Language). They must act as a bridge between statistics, decision science, data science and data art, combining analytical skills and sophisticated models developed by mathematicians and statisticians. They should collaborate closely with the IT specialists in cross-functional and multidisciplinary teams. They are expected to possess a combination of Data transformation, Data collection services and Data warehousing. They should be able to tackle AI-powered, data-dominated future.

2. Awareness of Cyber and Information Security Laws:

Accounting professionals must be aware of cyber and information security laws because of increasing concerns that commercially sensitive data in the cloud is vulnerable to cyber-attack.

3. More Consolidation:

The Accounting industry will witness much more consolidation in years to come. The small firms will be collaborating with each other to share a niche expertise with each other. As AI tools gain insights from the data and questions, accounting firms may move closer to a tiered consulting model. Automation will reduce the need for lower-level accountants, but client demand for expert data analysis will increase the need for experienced accounting professionals having industry experience at a senior or manager level. Accounting professionals must find ways not only to measure big data as an organizational asset but also to use it as a measure of organisational performance. Further, creative ways of preparing and auditing financial statements, for improving the effectiveness, efficiency and efficacy of their work is needed.

4. Data Driven Auditing:

Auditing will become data-driven, and the use of data analytics and artificial intelligence will change how historical financial statements are audited. Accountants will need to provide the auditor intelligence to ask the right questions and have staff run data queries.

5. Blockchain and Robotics related Applications (Venkatesh 2018)

Blockchain-related applications will have to be used by accounting professionals in order to remain in accounting profession. Blockchain, which allows data to be exchanged with the help of a decentralized ledger, could transform corporate reporting. Robotic process automation promises to automate and reduce the cost of back-office processes. Digital issues to tackle include global tax implications for how goods and services are sold; where companies base their operations; robotics; and new competitors.

6. Real-time Reporting:

As a result of Big Data Analytics, accounting professionals will be better equipped to conduct predictive analysis, and real-time reporting and real-time audit will become a reality.

7. Modified Accounting and Auditing Standards:

Big Data will have increasingly important implications for creation and refinement of accounting standards. A change in accounting and auditing standards is needed to focus on data, the processes that generate them, and their analysis, balancing the need for disclosure with the need for protection of sensitive data, and to empower end users, and improve the efficiency of the capital markets.

8. Revised Accounting Curriculums:

There will be a need to modify the accounting curriculums to embrace data analytics as a core component. Therefore, the Board of Studies of various professional bodies must ensure to update the curricula to accommodate the challenges of Big Data Analytics, and to produce accounting professionals with enhanced technology skills, to act as data-driven decision makers.

9. Proper Coordination with IT Professionals:

Accounting professionals need to effectively coordinate with the IT Professionals designing The AI-powered financial systems. They can support data scientists performing exploratory analysis on Big Data by determining which data is valuable, choose an established valuation technique, and identify key suppositions.

10. Need for Positive Attitude and Mindset:

In order to exist and be successful in Big Data environment, accounting professionals must be keep a positive attitude and open mindset to enhance their technical skills through continuous learning.

HYPOTHESES FORMULATION

The subsequent null hypotheses were formulated;

H₀₁: there is no significant relationship on the use of financial accounting information big data and better disclosure that enhance investor trust

H₀₂: there is no significant relationship on the use of big data in refining existing accounting standards and developing the needed ones.

3.0 METHODOLOGY

This study used a survey research design approach to examine the relationship between the dependent variables and the independent variables. The study population consists of academics, financial analysts, accountants, business owners, investors and big data analysts having experience and awareness. The sample contains 300 items. Correct questionnaires reached 233 with a response rate of 77.66 %, which is an acceptable rate for conducting the statistical analytics. Likert Quintet Scales used (Completely disagree 5, disagree 4, neutral 3, agree 2, completely agree1). The researcher has measured the study's variables by using 5 sub-questions each.

Table (1) Collecting the Study' Questionnaire

Items	Distributed	Received	Refused	Response Percentage %
Academics	50	40	8	84
Financial Analysts	50	37	15	70
Accountants	50	35	13	74
Business Owners	50	42	10	80
Investors	50	38	12	76
Big Data Analysts	50	41	9	82
Total	300	233	67	77.66

Source: researcher's computation 2023

Estimation Results and Discussion of Findings

Data Analysis and results

The data collected were analysed as reflected in the tables below

Table (2) Coefficients of Consistency and Reliability Regarding Questionnaire

Axis	Statement	The number of elements	Consistency coefficient	Reliability coefficient
First	The impact of data analytics in advancing accounting Profession and business information for decision making	10	0.764	0.846

The consistency factor is measured by using Cronbach's alpha. Table No. (2) Shows that the values of the two reliability and consistency coefficients are high. The value of consistency coefficient reached (0.764), and the value of the reliability coefficient reached (0.846). Therefore, it can be said that coefficients are of well-significance and accepted for the study, upon which can be relied on in order to generalize the results of the study population.

Test of hypotheses

Hypothesis one (null) there is no significant relationship on the use of financial accounting information big data and better disclosure that enhance investor trust

Table 3: Financial accounting information big data and better disclosure that enhance investor trust

Elements	Academics %	Financial Analysts %	Accountants %	Business Owners %	Investors %	Big Data Analysts %
Big data analytics helps in providing relevance and objective and valuable information which helps in decision-making on the economic unit	76.4	82.1	70.5	74.8	81.7	88.4
Big data analytics assist in the improvement of understanding and analytics of the content of accounting	75.3	74.1	87.5	70.9	66.9	79.2

information						
Big data analytics assist to advanced understanding the annual financial reports by providing detailed data on the economic unit through discussions, phone calls and videos, which increase the reliability and quality of accounting information	85.7	77.7	81.2	74.0	84.2	78.7
Big data analytics helps to the improvement of understanding the nature of different operations of the economic unit and improves understanding of the strategic performance of the economic unit as a whole.	87.3	80.0	89.4	74.7	93.1	77.9
Big data analytics is useful in improvement of predicting future profits and risks, which increases the reliability and quality of accounting information.	71.1	75.6	88.7	77.4		81.5

Source: researcher's compilation 2023. Results of statistical analytics respondents' answers

Table 4: The Results of Z-Test

Variable	The Number of Variables	Mean	Standard Deviation	Standard Error Mean
Z1	5	2.37	0.412	0.045

The confidence coefficient is 99 %.

Table (4) above shows that the acceptance degrees general mean of the study sample's variables has reached (2.37) with standard deviation estimated at (0.412). This means that the degree of acceptance is very high among the study sample for all the proposed variables, therefore the alternative hypothesis is accepted that there is significant relationship on the use of financial accounting information big data and better disclosure that enhance investor trust.

Hypothesis two (null) There is no significant relationship on the use of big data in refining existing accounting standards and developing the needed ones.

Table 5 the use of big data in refining existing accounting standards and developing the needed ones.

Elements	Academics %	Financial Analysts %	Accountants %	Business Owners %	Investors %	Big Data Analysts %
Big data analytics leads to knowing the latest development of the economic unit, which improves the quality of accounting information.	74.4	69.1	67.0	79.9	88.2	76.5
Big data analytics to refining existing	71.5	68.3	87.1.	76.9	73.9	70.2

accounting standards for improving the opportunities for future growth of the business and measuring the performance of the economic units						
Big data analytics leads to improving the assessment of the company's performance, which increase the degree of confidence in accounting information.	70.6	87.3	77.5	74.9	71.5	78.7
Big data analytics leads to providing stakeholders with further information, which improves the quality of accounting information and then reduce the asymmetry of information.	68.7	78.3	66.9	76.6.	86.7	85.1
Big data analytics leads to improving information comparability among sectors of the economic unit or between a specific sector and its counterpart at the market.	66.1	63.9	68.7	67.1	77.3	82.7

Source: researcher's compilation 2023. Results of statistical analytics respondents' answers

Table 5: The Results of Z-Test

Variable	The Number of Variables	Mean	Standard Deviation	Standard Error Mean
Z1	5	2.20	0.303	0.031

The confidence coefficient is 99 %.

Table (5) above shows that the acceptance degrees general mean of the study sample's variables has reached (2.20) with standard deviation estimated at (0.303). This means that the degree of acceptance is very high among the study sample for all the proposed variables, therefore the alternative hypothesis is accepted that there is significant relationship on the use of big data in refining existing accounting standards and developing the needed ones.

Discussion of Findings

The study reveals that the two hypotheses tested has a high acceptance degrees level of an average percentage of (92.4%) and (86.98%) respectively, this goes to shows that the issue of big data analytics in advancing accounting profession and business information for decision making is very much germen. This also was observed in the results of Z-Test of the Standard Deviation of (0.412) and (0.303) respectively, which leads to the acceptance of the two alternatives hypotheses and rejecting of the null hypotheses.

4.0 CONCLUSION AND RECOMMENDATIONS

The study concluded that big data analytics improves and help business organizations take informed decisions to enhance their operational efficiency. The most important of these are: contributing to giving a comprehensive view of the economic unit, the development of the economic unit's strategy and business model, achieving a high competitive advantage for institutions, improving the quality of accounting information, providing appropriate information helping in rationalization of decisions

within the economic unit, defining performance at past and the source of future information. The Big Data is not only about huge volume, but also the velocity at which the data is generated and the varied sources from where it is coming. Big Data or small data does not in and by itself possess any value, unless we get some insights out of the data which will aid us in decision making. Using big data analytics, Today, Big Data Analytics is all pervasive and we can see its impact everywhere, be it education, Government, Media, Sports, Banking and numerous other fields. And it is not a big statement to make that Big Data is not the next big thing, it has already made it BIG. The world accepted the slogan that data is the new oil. Those who are able to gain out of the Big Data will remain in the business that is, survival of the fittest. This is the implication to the new millennium environment the professional accountant finds itself. Therefore, should be able to deal with the complex procedures. So that the accountant will be a big data analytics professional too.

The researcher recommends that all the stakeholders (academics, financial analysts, professional association bodies, accountants, business owners, investors and government) should be involves in

1. the necessity of teaching big data and business analyses in management sciences in our higher institutions particularly accounting and business department to promote students' knowledge, the continues enlightenment, holding workshops and training and retraining courses for researchers and academics to know the importance of analyzing big data and how to process, store, manage and use the analyzed data in the financial and accounting field because of its usefulness in today business since using big data can lead to better disclosure which in turn enhance investor trust.
2. The government and professional association continue to improve on the sustainability of accounting and the development of accounting standards as Big Data play a vital role in refining existing accounting standards and developing the needed ones.

References

- Andiola, L., Masters, E., & Norman, C. (2020) Integrating technology and data analytic skills into the accounting curriculum: accounting department leaders' experiences and insights. *Journal of Accounting Education*, 50
- Arvind, P. (2019) "Power of Artificial Intelligence & Big Data Analytics: Intelligence that Atanu, B. (2018). "Sport and the arrival of big data analytics: In World Cup soccer too, statistics is now the third eye", *The Times of India*, July, 14, 2018
- Barutçu, M. T. (2017), "Big Data Analytics for Marketing Revolution", *Journal of Media Critiques [JMC]*, Vol 3, (11), P-ISSN: 2056-9785 E-ISSN: 2056 9793
- Bansal, S. K., Batra, R. & Jain, N. (2018), "Blockchain: The Future of Accounting", *The Management Accountant*, June 2018, Vol.53,(6), Pp.60-65.
- Bernard, M.(2015) "A brief history of big data everyone should read", *World Economic Forum*, February 25, 2015.
- Blix, L. H., Edmonds, M. A. & Sorensen, K. B. (2021) How well do audit textbooks currently integrate data analytics. *Journal of Accounting Education*, 55.
- Brands, K. (2014), 'Big Data and Business Intelligence for Management Accountants', *Strategic Finance*, Vol. 96, (6), Pp. 64-65.
- Breur, T. (2015), "Big Data and the Internet of Things" Macmillan Publishers Ltd. 2050-3318 *Journal of Marketing Analytics* 2015 Vol. 3, (1), 1–4
- Cockcroft, S. & Mark, R. (2018), "Big Data Opportunities for Accounting and Finance Practice and Research: Big Data in Accounting and Finance." *Australian Accounting Review*, February 2018, Pp.1-13.
- Coyne, E. M., Coyne J. G. & Walker K. B. (2018). Big Data information governance by accountants. *International Journal of Accounting & Information Management*, 26 (1): 153-170.
- Dave, S. (2021) Several companies, individuals get tax notices as data analytics uncovers gaps in filings.
- Earley, C. E. (2015). "Data Analytics in Auditing: Opportunities and Challenges." *Business Horizons* 58.5 P 493-500.
- Ehioghiren, E. E. & Ojeaga, J. O. (2022) Cloud-based Accounting Technologies: Preparing Future-Ready Professional Accountants. *International Journal of Innovative Science and Research Technology*, vol. 7(2) p 879-889
- Fanning, K. & Grant, R.(2013), 'Big Data: Implications for Financial Managers', *The Journal of Corporate Accounting & Finance*, Vol. 24, (5), Pp. 23-30.
- Griffin, P., & Wright, A. (2015). Commentaries on Big Data's importance for accounting and auditing. *Accounting Horizons* , 29 (2), 377–379.
- Hagel, J.(2013), 'Why Accountants Should Own Big Data', *Journal of Accountancy*, Vol. 216, (5), Pp. 20-21.
- Hsin-Yu, C. (2020). Use of Business Analytics in Accounting Firms—Taking Deloitte as an Example . *E3S Web of Conferences* 218, 03004 (2020) <https://doi.org/10.1051/e3sconf/202021803004>
- Kaya, I., & Akbulut, D. H. (2018). Big data analytics in financial reporting and accounting. *Press Academia Procedia (PAP)*, V.7, p. 256- 259
- Krahel, J.P. & Titera, W.R. (2015), 'Consequences of Big Data and Formalization on Accounting and Auditing Standards', *Accounting Horizons*, Vol. 29, (2), Pp. 409-422.

- Margaret, R. (2018)“big data analytics”, TechTarget, 28th September 2018
<https://searchbusinessanalytics.techtarget.com/definition/big-data-analytics?vnextfmt=print>
- Maurer, M. (2020) Why you don't need to be an accountant to be a CFO. The Wall Street Journal. [https://www.wsj.com/articles/companies -appointing - fewer - finance - Chiefs -with-accounting- skills - 11580293801](https://www.wsj.com/articles/companies--appointing-fewer-finance-chiefs-with-accounting-skills-11580293801)
- Moffitt, K. C., & Vasarhelyi, M. A. (2013). AIS in an age of Big Data. *Journal of Information Systems* , 27 (2), 1-19.
- Murthy, U. S., & Geerts, G. L. (2017). An REA Ontology-Based Model for Mapping Big Data to Accounting Information Systems Elements. *Journal of Information Systems* .
- Moore, W. & Felo, A.(2021) The evolution of accounting technology education: Analytics to STEM. *Journal of Education for Business*, 1-7.
- Nagat, M. M. Y. (2020) .The Impact of Big Data Analytics on Improving Financial Reporting Quality. *International Journal of Economics, Business and Accounting Research (IJEBAR)* 4(3), P 91-106
- Princy, L. (2018).“How Indian Government Is Using Big Data Analytics To Improve Economy And Public Policy”, *Analytics Insight*, June 28, 2018
- Prokopowicz, D. & Gwozdziejewicz, S. (2017). “The Big Data technologies as an important factor of electronic data processing and the development of computerized analytical platforms, Business Intelligence”, *International Journal of Small and Medium Enterprises and Business Sustainability*”, Volume 2, (4), November 2017,Pp. 27-42.
- Richardson, V. & Watson, M. W. (2021) Act or be acted upon: revolutionizing accounting curriculums with data analytics. *Accounting Horizons*, 35(2), 129-144.
- Richins, G. Stapleton, A., Stratopoulos, T. C. & Wong, C. (2017), Big Data Analytics: Opportunity or Threat for the Accounting Profession?, *Journal of Information Systems* Sep 2017, Vol. 31, (3), Pp. 63-79.
- Sanchez, M. (2019). 5 Ways Accountants Can Effectively Utilize Big Data. available at: <https://www.accountingweb.com>.
- Schmidt, P., Riley, J. & Swanson C. K. (2020) Investigating accountants' resistance to move beyond Excel and adopt new data analytics technology. *Accounting Horizons*, 34(4), 165-180.
- Schneider, G.P, Dai, J, Janvrin, D.J, Ajayi, K. & Raschke, R.L. (2015), ‘Infer, Predict, and Assure: Accounting Opportunities in Data Analytics’, *Accounting Horizons*, Vol. 29, (3), Pp. 719-742.
- Shastri, N., & Rajpurohit, N. (2017). Employee Engagement Analytics: Enhancing the Firm Value. *The Management Accountant* , 52 (11), 31-35.
- Shastri, N., & Rajpurohit, N. (2018). Engaging the Millennials: Need of the Hour for Indian PSBS. *The Management Accountant* , 53 (1), 22-26.
- Shastri, N., Wadhwa, R., & Rampal, Y. (2018). Skill Gap in Accounting Education for Prospective Managers. *The Management Accountant* , 53 (11), 66-70.
- Shastri, N., & Vaidya, P. (2019). Cashless India: The Way Ahead. *The Management Accountant*, 45-51.
- Sicular, S. (2013). “Gartner’s Big Data Definition Consists of Three Parts, Not to Be Confused with Three “V”s”, *Forbes* (2013) March 27, 2013 from <https://www.forbes.com/sites/gartnergroup/2013/03/27/gartners-big-data-definition-consists-of-three-parts-not-to-be-confused-with-three-vs/#6cb1128e42f6>
https://www.webopedia.com/TERM/B/big_data.html

- Sperkova, L., Vencovsky, F., & Bruckner, T. (2015). How to measure quality of service using unstructured data analysis: A general method design. *Journal of Systems Integration* .
- Tan, K. H., Ji, G., Lim, C., Tseng, M. L. (2017), "Using big data to make better decisions in the digital economy", *International Journal of Production Economics*, Vol.55, Pp. 4998-5000.
- Tang, J., & Khondkar, K.(2017a). "Big Data in Business Analytics: Implications for the Audit Profession." *The CPA Journal*, 22 June 2017, Retrieved from www.cpajournal.com/2017/06/26/big-data-business-analytics-implications-audit-profession/. [Accessed on July 20, 2020]
- Tang, J., & Khondkar, K. (2017b): "Big Data in Accounting." *Internal Auditing*32.2 (29-31
- Taylor, C. (2017). "Big Data Security" www.datamation.com
<https://www.datamation.com/big-data/big-data-security.htm>
- Thornton, G. (2014). Comparison between U.S. GAAP and International Financial Reporting Standards. Retrieved from <http://www.grantthornton.ie>:
<http://www.grantthornton.ie/db/Attachments/GTUS-Comparison-Document-April2014.pdf>
- Tykheev, D. (2018), "Big Data in marketing", Research Thesis, Saimaa University of Applied Sciences, South Karelia, Finland
- Tysiac, K. (2019). Report finds shift in accounting firm hiring. *Journal of Accountancy*.
<https://www.journalofaccountancy.com/news/2019/aug/accounting-firm-hiring-trends-201921801.html>
- Vasarhelyi, M. A., Kogan, A., & Tuttle, B. (2015). Big Data in Accounting: An Overview. *Accounting Horizons* , 29 (2), 381–396.
- Venkatesh, N.(2018). "Comparative Analysis of Big Data, Big Data Analytics: Challenges and Trends", *International Research Journal of Engineering and Technology (IRJET)*, May 2018
- Verma, E. (2016), "How big is Big Data?" , from <https://www.simplilearn.com/how-big-is-big-data-rar335-article>, November 2, 2016 <https://www.dexlabanalytics.com/blog/6-mind-blowing-facts-on-big-data-everyone-must-know>
<https://blog.samanage.com/insights/whats-the-difference-between-structured-and-unstructured-data/> <http://www.cisco.com/web/solutions/trends/iot/portfolio.html>
<https://www.simplilearn.com/data-science-vs-big-data-vs-data-analytics-article>
- Warren, J. D., Moffitt, K. C., & Paul, B. (2015). How Big Data will change accounting. *Accounting Horizons* , 29 (2), 397–407.
- Wong, G. R. (2017). Big Data Analytics: Opportunity or Threat for the Accounting Profession? *Journal of Information Systems American Accounting Association*
- Yoon, K., Hoogduin, L., & Zhang, L. (2015). Big Data as complementary audit evidence *Accounting Horizons* , 29 (2), 431–438
- Yuri, D.(2014)"Defining Architecture Components of the Big Data Ecosystem", CTS2014 Conference, Minneapolis, USA, 19-23.