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The Role of Big Data in Transforming the Nature of Accounting System

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Abstract:

Recent changes in technology introduced by the advent of the 21st century have drastically transformed the face of accounting in recent time from its analogue nature into a digitalized package. These technological advancements have modernized accounting systems and packages which created opportunity for accounting tasks to be performed in an easier, faster, and efficient manner. By the virtue of these technological developments, the concept of big-data was discussed. This research focused on evaluating the impact of the big data concept in shifting the norms of the financial accounting and reporting. This research reveals amongst others the weaknesses of the current accounting conceptual framework to ascertain the relevance of the recent advancements in accounting packages and software. The design of the research is based on providing literature review of the history by undertaking a relatively holistic view of the big data influence on financial accounting and reporting system.

Key words: Bid data, Information technology developments, accounting nature.

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1. INTRODUCTION

The spread of data that has launched the Fourth Industrial revolution, an era when business will be transformed by cyber-physical systems, has enabled several technological trends to develop. Virtually every business competing in today's dynamic market environment is expected to be able to utilize these important trends and to pay attention to how best to use them. Thus, these technological advancements are forcing senior executives to reconsider their organizations' traditional business and operating models. Also, through this transformation journey accountants and the accounting standards boards should really evaluate how these recent technological advancements and trends can be examined strategically to achieve the accounting conceptual framework's objectives for business strategy.

The introduction of these recent trends in technology and the evolution of customers' expectations mean that the extent of connectivity and the volume of data needed about any firm's business are growing at an exponential rate, leading to the emergence of big data methodology that was enabled firstly by recent advances in technology. The term big data is derived from the fact that today data isn't just numbers and spreadsheets that accountants have been familiar with for years, it also includes unstructured data that can't be stored or analyzed through the traditional database processing systems. Thus, datasets became large because data has many new sources that are not restricted to structured database records, but include data that having no standard formatting, including e-mail, social media, and Internet-accessible sensors.

One of the methods exploited by management to make advantage of the enormously complex and dynamic amount of available information and data generated by financial institutions is data mining. Data mining (DM) as a process of discovering valid, complex, and not obvious hidden information from large amounts of data by noticing useful patterns and correlations. For this reason, another equivalent term for DM is knowledge discovery in databases (KDD) as it contributes to the classification and prediction problems and facilitate the decision-making process.DM has been used widely in many different business applications, such as predicting credit card default, the buying patterns of consumers, and predicting events such as auditor changes and firm bankruptcy.

The characteristics of big data, its storage and analysis challenge the adequate disclosure of data for businesses. Many argue that current accounting conceptual framework and standards are artifacts of an era subjected to high transmission costs and slow data collection speeds, however, such working conditions have become obsolete. To be relevant, accounting conceptual framework must focus on data rather than presentation. Accordingly, the accounting standards will be required to deal with the content of such databases and the allowable sets of extractions but not with the rules of account disclosure. Thus, is important for the future accounting framework to set standards that deal with the need for disclosure with the need for protection of sensitive data. Also, another area where big data may substantially affect is fair value accounting. Data service companies specializing in collecting and evaluating designated data from various sources can come into view, such that big data pertaining to the fair value of assets and liabilities can mitigate subjective assumptions in fair value estimates. (Coyne, Coyne, & Walker, 2018)

This article will discuss the implications of big data on accounting nature, as well as the continuing efforts by researchers that focused on pointing out these implications. This article would start at the first part by addressing a concise overview of big data and its meaning, also address big data dimension and characteristics, big data sources and value chain. This part also will provide a brief understanding about the importance of big data in business environment. Part II of this article gives a brief background about the impact of big data on current accounting nature and financial reporting, big data impact on asset measurement and disclosure, and the impact of big data on accounting estimate.

1. An overview of big data

Big Data, whose name implies that it will be massive in volume, is today's and tomorrow's technology. According to scientists and researchers, it currently rules the world and will continue to do so in the near and distant future. Big Data is defined as a data analysis methodology enabled by a new generation of technologies and architecture that enable high-velocity data capture, storage, and analysis. It was also defined by (Gartner, 2016) as large-scale, fastflowing, and highly diverse information assets that necessitate economically feasible and innovative processing methods. Big data can come from anywhere and appears to grow indefinitely, it is no longer limited to structured database records, but also include unstructured data – data that does not follow a standard format. It now takes up massive amounts of space, ranging from gigabytes to exabytes and even zeta bytes. Big data, due to its massive size, is not stored in traditional ways or databases.

Academics define big data as massive amounts of unstructured data generated by a diverse set of high-performance applications ranging from social networking to scientific computing. The datasets range in size from a few hundred gigabytes to zettabytes, which are too large for existing data management tools to capture, store, manage, and analyze (Cuzzocrea, Song, & Davis, 2011); (Qin, 2012); (Agneeswaran, 2012). According to (Gartner, 2016) big data is defined as high-volume, high-velocity, and/or high-variety information assets that require cost-effective and innovative forms of information processing to provide enhanced insight, decision making, and process automation.

Big data was defined as "datasets that could not be captured, managed, and processed by general computers within an acceptable scope" (Chen, Mao, & Liu, 2014). Following this, the McKinsey Global Institute defined big data in 2011 as "datasets whose size exceeds the ability of typical database software tools to capture, store, manage, and analyse" (Manyika, et al., 2011). According to International Data Corporation (IDC), "big data technologies are a new generation of technologies and architectures designed to economically extract value from very large volumes of a wide variety of data by enabling high-velocity capture, discovery, and/or analysis" (Gantz & Reinsel, 2011)

Big data also refers to the techniques and technology used to derive conclusions from a wide range of data types. These techniques frequently attempt to indicate non-linear relationships and causal effects from data that is frequently deficient in information. Because of the nature of the data, these techniques frequently make no or very few distributional assumptions. Computer scientists approach big data by looking for patterns in the entire record – this is known as the algorithmic approach. The patterns are thought to be approximations of the data set's complexity.

Statisticians, on the other hand, are more likely to treat data as observations of an underlying process and to extract information and draw conclusions about the underlying process.

big data can be classified into three types: structured data in database fields that can be searched, analyzed, and managed using structured query language (SQL). Unstructured data refers to any data that cannot be easily classified as pictures, visuals videos, Pdf files, e-mails, web links, Posts on Facebook, chat logs, tweets, and so forth. Although these files have their own internal structure, they are considered unorganized because their data is not as consistent as a database. Semi-structured data is a hybrid of the two, but it lacks the unorganized structure that Word processing programs have.

Though big data has been defined in a variety of ways, there is no single definition. Few have defined what it does, and even fewer have defined what it is. The definition of big data based on the 3Vs is relative. What defines big data today may not be the same tomorrow. For example, with advancements in storage technologies in the future, data that is considered big data today may be captured. In addition to identifying big data, it is necessary to understand how to best use this data to obtain useful information for decision making.

2. Big Data Dimensions and characteristics

Initially, big data was characterized by the following dimensions, which were, often, referred as 3V model. Big Data's high volume, high velocity, and high variety have revolutionized many aspects of traditional data storage, processing, and analysis systems, as well as created many new challenges. These three Vs (volume, velocity, and variety) have been identified as the primary dimensions and characteristics of Big Data that distinguish it from traditional data. The discussion in this section focuses on Big Data characteristics, as originating data play critical roles in data capture, storage, and analysis.

Big Data is essential for understanding humans and machines because both are data-generating agents. It has been identified and acknowledged as an important current and future research factor. As a result, recognizing Big Data's characteristics is crucial before discussing it in various contexts. Analyzing and debating various (Vs) researched by numerous authors in academic papers will lead to better understanding of the data and the real value of Big Data. Laney used the 3Vs to define and categorize the concept of Big Data (volume, velocity, and variety). Others have discussed 'value' as a fourth V in Big Data, and others have added 'veracity' as a fifth V in Big Data. However, Big Data is still in its infancy and has not been thoroughly examined.

i. Volume:

The term "data volume" refers to the large data set generated by scientific and educational records, as well as business and human interaction records. Data volume is important in storage and processing. However, due to rapidly developing storage technologies on the one hand and decreasing storage prices on the other, storage capacity poses less of a challenge than processing. As a result, cost-effective storage solutions and Cloud technologies enable organizations to store data. However, data volume has a significant impact on data processing, data management, and decision making. Because the size of data has increased faster than the computational power of the processing system.

ii. Velocity

The rate at which data is generated is referred to as data velocity. There are two methods for importing data: batch data, which loads the entire dataset at once, and streaming data, which imports and processes data as it is generated. Stream processing is critical when selecting a Big Data analysis platform because real-time processes are frequently time sensitive and require faster and near-instant analytics results. (Gandomi & Haider, 2015)

iii. Variety

The term "variety" refers to the various types of data that are generated and captured. They go beyond structured data and are classified as semi-structured and unstructured data (Gandomi & Haider, 2015). Structured data is data that can be organized using a pre-defined data model. Structured data is represented by tabular data in relational databases and Excel, and it accounts for only 5% of all existing data. Unstructured data, such as video, text, and audio, cannot be organized using these pre-defined models. Semi-structured data is data that falls somewhere between structured and unstructured data. This category includes Extensible Markup Language (XML).

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the importance of big data's veracity dimension, which is the quality of the data and the level of trust in various data sources. If big data is of poor quality, when combined with other data and information, a false correlation may be formed, leading to incorrect business analysis and decision making. The value dimension of big data is concerned with the hidden economic benefit that must be identified, transformed, and extracted through analysis of a larger body of structured and unstructured non-traditional data.

So, literature can identified the following characteristics of big data. Size: indicates that there are more data quantities than in traditional methods, necessitating the use of processors and devices capable of dealing with that data. Speed: indicates that serious data is delivered more quickly than traditional data. Diversity: denotes that the data is more than just traditional digital accounting data and includes a variety of other types of data such as images, sound, video, and text. Truthfulness: Refers to the data's dependability, as beneficiaries are concerned about the data's quality, and not all data can be used in the service of institutions and decision-making, so some data is eliminated. Value: represents the contribution of data to making sound decisions in a timely manner for businesses.

According to (Georde, Samsonova, & Turley, 2018), big data characteristics when met they give institutions a significant competitive advantage and aids in the rationalization of decision making. They contribute to providing a comprehensive view of the company, developing a strategy and road map for business enterprise, primarily in customer participation, automated operations, and predictive decision-making analysis. They also help in much more effective preparation of integrated reports by utilizing both financial and non-financial data to disclose the performance of the company.

3. Big data sources

Humans' basic and primary instinct is directed by tempting to learn through observation and errors. To learn from those observations and errors, data is needed to understand the behavior and events of the incident we are attempting to avoid or decrease its likelihood. Most of the time,

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data for this type of learning is not small; it is massive, which is why it is referred to as big data. As a result, the first step is always data collection. Some data sources, such as sensors and other electric circuits, generate massive amounts of raw data, but the drawback is that most of that data is useless to us and should be filtered. As a result, the first step is to design and apply appropriate filters to obtain the required useful data. After applying the appropriate filter, the second step is to extract information from the raw data. The real challenge begins in the third step, which is analyzing the filtered-out information, which is far more difficult than simply identifying, locating, and citing data. (Gartner, 2016).

4. The need of big data

Data has become a vital part of everyone's life, and it has proposed numerous solutions to numerous serious real-world problems. It is difficult to store and retrieve large amounts of structured and unstructured data with a reasonable time lag. Some of these limitations in handling and processing large amounts of data with traditional storage techniques resulted in the coining of the term "Big Data." Although big data has gained popularity since the advent of the Internet, it cannot be compared to it. It goes beyond the Internet, but the Web makes it easier to collect and share raw data as well as knowledge. Big Data is concerned with how data can be stored, processed, and comprehended in such a way that it can be used to predict future course of action with high precision and acceptable time delay. In simple terms, Big Data plays a critical role in observing the behaviors and patterns of any system over time and assisting us in forecasting the system's future, but the way big data is used may vary. Big Data has applications in every field of life, but only a few of them are addressed below.

i. Social Attitude

The nature of mankind is changing as technology advances over time, but the major difficulty here is that this transition of attitude is not very dynamic, and it is also not easy to study. To understand how people react to any idea now vs. how they reacted in the past is required, so that we need to understand the level of change over the years. We need people's opinions for this purpose, and there are billions of people on the planet, which is where Big Data comes in

ii. Software testing

Software testing is all about observing the behavioral pattern of the software and how it will act in different circumstances and under varied conditions so that we can discover bugs and errors and improve and optimize the software. To get the desired output from any system, we must first provide the input, which in this case is always data, and not just a tiny quantity of it, but a massive amount of information and data on every function and option reveal in the software and how it operates in different scenarios.

iii. Machine learning

The main goal today is to master Artificial Intelligence (AI), and machine learning is a key component of AI. Machine learning is essentially giving the system the ability to self-improve and learn without being explicitly programmed. The main input required by the system to improve itself in Machine Learning (MI) is a continuous supply of data. The MI software automatically filters the data, extracts the necessary information, and analyses it. It observes and takes steps to automatically improve itself based on the extracted information. Machine learning assists us in overcoming the challenges of automating and modernizing workflows.

Machine Learning and Big Data are related because they are both components of data sciences and have the same goal of learning through data analysis. As previously stated, Big Data is used to identify patterns in data and trends in people from which data is derived, whereas Machine Learning uses all of this to automatically improve the system. Big Data analysis is also referred to as the preprocessing stage of Machine Learning. As a result, collaboration between Big Data and Machine Learning is strongly advised.

5. Big data value chain

Porter's (1980) concept of the Value Chain refers to a set of activities performed by a firm to add value at each step of providing a product/service to its customers. Similarly, a data value chain is a framework that deals with a set of activities to create value from existing data. It has

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seven stages: data generation, data collection, data transmission, data pre-processing, data storage, data analysis, and decision making.

i) Data Generation: First and most important step in the big data value chain is data generation. As mentioned in the previous section, data is generated from a variety of sources, including Call Detail Records (CDR), blogs, Tweets, and Facebook Pages.

ii) Data Collection: During this phase, data is gathered from all available data sources (Miller & Mork, 2013); (Chen, Mao, & Liu, 2014). For example, to predict customer churn in telecom, data from CDRs and customer opinions/complaints on Social Media Platforms such as Twitter (in the form of tweets) and Facebook (opinions shared on the company's Facebook page) can be obtained. Log files, sensors, web crawlers, and network monitoring software are the most commonly used methods (Chen, Mao, & Liu, 2014).

iii) Data Transmission: After collecting the data, it is transferred to a data storage and processing infrastructure for further processing and analysis. It is divided into two stages: inter-Dynamic Circuit Network (DCN) transmission and intra-DCN transmission. Inter-DCN transmission is concerned with the transmission of data from the data source to the data center, whereas intra-DCN transmission is concerned with data transfer within the data center. Aside from data storage, data centers assist in data collection, organization, and management.

iv) Data Pre-processing*:* Because the data gathered from various data sources may be redundant, noisy, and inconsistent, the data is pre-processed in this phase to improve the data quality required for analysis. This also aids in improving the accuracy of the analysis and lowering storage costs. *The following steps can be used to pre-process the data :*

a) *Integration:* Data from multiple sources is combined to provide a unified and consistent view of the available data. The two most common traditional methods are data federation and data warehousing. The Extract, Transform, and Load (ETL) process is carried out by data warehousing. The data is selected, collected, processed, and analyzed during the extraction process. The procedure for converting extracted data to a standard format is known as the Transformation process. Loading is the process of importing obtained and transformed data into a storage infrastructure. Data is aggregated from multiple data sources using only a virtual database to make data integration dynamic. It does not contain any data, but it does provide details about information pertaining to original data or metadata (Miller & Mork, 2013); (Chen, Mao, & Liu, 2014).

b) *Cleaning:* The data is analyzed for correctness, completeness, and consistency. During this process, data may be deleted or modified in attempt to optimize data quality. The general process includes the following five steps: error types are defined and determined, errors are identified from data, errors are corrected, error types and corresponding examples are documented, and data is collected.

c) *Removal of Redundant Data:* Many datasets have excess data or data repetitions, which is referred to as data redundancy. This raises storage costs, causes data inconsistency, and has an impact on data quality. Various data reduction methods, such as data filtering and compression, are used to overcome this. These data reduction techniques have the disadvantage of increasing the computational cost. As a result, before employing data reduction techniques, a cost-benefit assessment should be undertaken.

v) *Data Storage*: Big data storage systems must provide dependable storage space as well as powerful data access. Distributed storage systems for big data should take into account factors such as consistency (C), availability (A), and partition tolerance (P). According to Brewer's (2000) CAP theory, distributed storage systems can meet two requirements at the same time, namely consistency and availability, availability and partition tolerance, or consistency and partition tolerance, but not all requirements at the same time (Gilbert and Lynch, 2002). Significant research is still being conducted in the field of big data storage mechanisms. Google File System (GFS), Dynamo, BigTable, Cassandra, CouchDB, and Dryad have made little progress in this regard.

vi) Data Analysis: After the data has been collected, transformed, and stored, the very next process is data exploitation or data analysis, which is outlined using the steps below:

a) Define Metrics: For a specific problem, a set of metrics is defined based on the collected and transformed data. For example, to determine the potential customer who is likely to churn, the number of times he or she was contacted (whether through a voice call, tweets, or complaints on a Facebook page) can be taken into account. (Miller & Mork, 2013).

b) *Choose an architecture based on the type of analysis:* A suitable architecture is selected based on the timeliness of the analysis to be conducted. Real-time analysis is used in domains where data is constantly changing and rapid analysis is required to take action. Existing architectures include memory-based computations and parallel processing systems. Real-time analysis is used to detect fraud in the retail and telecommunications industries. Offline analysis is used for applications that do not require a fast response time. The data can be extracted, saved, and analyzed at a later date. The Hadoop platform is the most commonly used architecture (Chen, Mao, & Liu, 2014).

c) *Selection of appropriate algorithms and tools:* Among the most important steps in data analysis is the selection of appropriate techniques for data analysis. Few classical data analysis techniques, such as cluster analysis, regression analysis, and data mining algorithms, are still useful for big data analytics. Cluster analysis is an unsupervised technique for grouping objects based on some features.

d) *Data visualisation:* arose from the need to inspect details at multiple scales and in minute detail. Visual interfaces, in conjunction with statistical analyses and related context, aid in the identification of patterns in large amounts of data over time. The definition of Visual Analytics (VA) is "the science of analytical reasoning facilitated by visual interactive interfaces". Tableau, QlikView, Spotfire, JMP, Jaspersoft, Visual Analytics, Centrifuge, Visual Mining, and Board are a few visualisation tools. Zhang et al. discuss a comparison of visualisation tools based on their data handling functionality, analysis methods, and visualisation techniques. (Al-Htaybat & von Alberti-Alhtaybat, 2017)

vii) Decision Making: Decision makers can decide whether and how to reward positive behaviour and change negative behaviour based on analysis and visualisation of the results. The specifics of a problem can be analysed in order to understand the causes of the problem, make informed decisions, and plan for appropriate steps (Miller & Mork, 2013).

After discussing how value can be extracted from big data, an industry, regardless of sector, must consider three criteria before implementing big data analytics: can valuable information be obtained in addition to those obtained from current systems, will there be any improvement in the accuracy of information obtained using big data analytics, and will implementation of big data analytics help in improving response timeliness. (Krahel & Vasarhelyi, 2014)

The most valuable factor in big data analysis and decision making is the selection of appropriate techniques for such analysis. Few classical data analysis techniques, such as cluster analysis and data mining algorithms, are still useful for big data analytics. Cluster analysis is an unsupervised technique for grouping objects based on some features. Data mining techniques aid in the extraction of unknown, hidden, and useful information from large data sets. Thus, the coming section will discuss the most powerful data analysis technique which is data mining algorithms.

II. Big data implications

1. The impact of big data on current accounting nature

The application of advanced digital technologies, particularly the internet and mobile technology, has greatly accelerated the trend of data generation and contributed to the emergence of the big data phenomenon. Nowadays, global data production doubles every 18 months, and organizations have collected more data in the last two years than they have in the previous years. As latest types of data are becoming available, big data will get an increasing impact on accounting. Big Data's video, audio, and textual information can help improve managerial accounting, financial accounting, and financial reporting practices.

According to the literature, big data includes the following:

Image and video data: Because of the abundance of image and video capture devices, visual data is becoming more widespread and rapidly as the use of this data is now a reality for enhancing

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accounting records such as storing photos and video, and includes workplace video to track worker productivity and inventory video to evaluate changes in the amount of actual time to measure productivity and determine bottlenecks and, without a doubt, image and video analytics focus on providing useful statistics for business operations.

There is an increase in video, image, audio, and text data, which tends to affect traditional accounting records and information. Big data analytics will have an impact on financial accounting by influencing data collection, recording, and management, as well as financial statement preparation. Text, video, and audio data are linked with traditional data by strengthening accountants' analytical skills. Furthermore, big data appears to affect the fair value of assets and liabilities by reducing the estimate of subjective assumptions.

Voice data: Voice records pertaining to the company's activities improves accounting records and the quality of financial information. Audio sources are including conference calls, shareholder and board meetings, customer calls, and internal phone calls to employees. (Mayew & Venkatachalam, 2012) research reveals that analysing voice data results in quarterly profit gains, quality product, and knowledge of customer satisfaction. The study concluded that there is a positive relationship between the signs of phonological cognitive dissonance, the possibility of declaring violations, and the presence of a moral correlation between profit conference calls and stock returns.

Text data: Non-financial documents such as emails, web pages, the number of Facebook members, and Twitter users are examples of text data, and data from these source materials will be useful to support marketing and providing early warning to customer service about product defects. According to literature, analyzing big data will impact financial accounting by affecting how data is collected, managed, financial statements are prepared, and audited. In financial accounting, an information system is used to record, store, retrieve, summaries, analyse, and present transactions and financial and economic events. As a result, accounting information systems with big data analyses can be a driving force for organizational management progress, and the study revealed two directions for big data in financial accounting.

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Big Data has an impact on financial accounting by influencing how data is collected and recorded, data management, financial statement preparation. Where, financial accounting is an information system for recording, storing, retrieving, summarizing, analyzing, and presenting financial and economic transactions and events. Big Data is expected to be connected to financial accounting by integrating various data sources into accounting information systems. Text, video, image, and audio data, for example, are gradually linked to traditional data, requiring accountants to enhance their performance and skills when using and analyzing big Data. Consequently, accounting information systems with big data analysis can be a driving force for successful organization management.

Big data provides businesses a significant competitive advantage by rationalizing decision-making, Contributing to the development of a business strategy and a comprehensive overview of the company. Also, it supports more effective integrated reporting by utilizing both financial and non-financial information to disclose the company's performance. It improves risk management and uncovers cost-cutting opportunities. Big Data assists business in better understanding customer behavior to increase customer satisfaction, business efficiency, sales, and continuous opportunities for innovation in process and product development. Big Data represents the future and evolving aspect of the information industry and value creation with the goal of developing the economy, promoting growth, increasing productivity, and product quality, and that big Data analysis helps to increase the knowledge content of financial information.

Big Data may have an impact on fair value accounting in the sense that Big Data pertaining to the fair value of assets and liabilities may reduce subjective assumptions in fair value estimates. The study emphasized the importance of Big Data in accounting and auditing, with Big Data techniques used in financial failure forecasting, stock market forecasting, and quantitative modelling models. The study highlighted the significance of Big Data and its implications for the accounting profession, where image, video, audio, and text data improve management accounting, financial accounting, and financial disclosure practices. Big Data will aid in the development of management control systems and the efficiency of budget preparation processes

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in management accounting. Big Data will improve the quality and relevance of financial accounting. Thereby, stakeholders will benefit from increased transparency and rationalized decision-making. Big Data in financial disclosure helps to create and improve accounting standards, ensuring that the accounting profession continues to provide accurate and useful information as the global economy evolves.

2. Big data and financial reporting

Financial reporting is defined as a variety of elements that work together to achieve the ultimate goal of providing information to assist information users in making different decisions. In the same context, the financial reporting system is defined as an information system made up of a collection of interconnected elements that are in charge of external financial reporting. Financial reporting can also be defined as the process of issuing and preparing financial information about an economic unit, which includes general purpose financial statements and the tables that accompany them.

Transparency is the primary objective of corporate reporting and governance systems, by using financial and non-financial metrics for performance evaluation, they concluded that there are too many significant opportunities that allow data to improve financial reporting quality. Big data can integrate disparate and irregular data sources into a single integrated information accounting system. Financial reporting is the end outcome of financial accounting and is of primary concern to management and stakeholders. Nevertheless, traditional corporate reporting does not fulfil the evolving needs of users. Financial reports are frequently released to the public after being audited later in the fiscal year, implying that some information may be out of date. Investors and other stakeholders now require daily, if not hourly, financial information.

One of the big data dimensions in this regard is velocity, which refers to the rate at which data is being processed and created; big data systems can now process and create data in real-time. This could allow companies release financial reports in a timely manner. Royal Bank of Scotland, Walmart, and Amazon, for example, have implemented big data systems that process and provide data in real time. This suggests that when businesses implement a big data system, it can have a significant impact on their ability to provide financial reporting to the public during a desirable period.

BDA employs data mining to extract knowledge from a data warehouse or a large dataset to aid decision making by developing predictive models to forecast future opportunities, threads, and analysing business process optimization. As a result, big data analytics provide the capability of capturing "sequential causational and correlational processes" in real-time and may dramatically alter legacy financial accounting and reporting, which relied on structured data and successive layers of summary and aggregation and reports on a periodic basis.

(Arnaboldi, Busco, & Cuganesan, 2017) conducted a literature review and concluded that big data could improve financial reporting quality by converting narratives into numbers and visualizing them. He also stated that in the information age, management is under massive pressure to provide more integrated reporting that includes non-financial data in addition to traditional financial data. Integrated reporting acknowledges the importance of non-traditional indicators and predictors in company annual reports and long-term assessments—and thus elevates the importance of big data. As a result, an integrated enterprise resource planning (ERP) system is required to store each piece of data that enters the company and should be designed to summarize and report both financial and non-financial data.

Quality refers to the set of characteristics that accounting information must have to provide useful information that meet the needs of its users, such as understandability, reliability, relevance, comparability, and, most importantly, the ability of the information to influence the decisions of the users of those reports. The characteristics of accounting information contained in financial statements and reports are defined as accounting information quality. These characteristics aid in assessing the quality of accounting information, making decisions, and forecasting financial failure. Accounting information quality is defined by its readability, relevance, dependability, and comparability. The methods of measuring the quality of financial reports used in research studies differed because there are many ways. The coming section will show the studies that measure the quality of financial reports using accounting information quality characteristics such as relevance, reliability, comparability, and understandability.

i. Big Data and Understandability Characteristic

Big data analytics leads to improved understanding and analysis of the content of information

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enclosed in financial reports, displaying unclear information, having a better image of the company, striving to improve understanding of other data held in reports such as discussions, phone calls, and videos, enhancing understanding of the company's strategic performance, improving understanding of the company's various operations, and then improving the undivided attention of the company's stakeholders. A better opinion can be formed by relying on comprehensive information about the company, which allows the identification of the company's success or failure.

According to (Lattabi, 2018) big data represents the future and developed aspects of the information industry and value creation with the goal of economic development, promoting growth, rationalizing decision-making, increasing productivity, and product quality. big data analytics can help increase the cognitive content of financial data, especially when allocating portfolios. As a result, the researchers concluded that big data analytics improves accounting information comprehension.

ii. Big Data and the Relevance Characteristic

Big data analytics has a positive impact on the facility by improving the predictions about future profits and risks, enhancing the prediction of future growth opportunities, predicting financial fraud, early detection of weaknesses and strengths, enhancing the evaluative capability of financial reports, and thus enhancing the evaluation of the company's performance. According to studies (Singh, 2020), (Gepp, Linnenluecke, ’Neill, & Smith, 2018) big data is important in accounting and auditing because it helps yield efficient data-driven audits, thus creating a better experience for auditors; in the tax process, it helps evaluate tax codes, prevent fraudulent acts, and monitor budget and tax expenses; where big data technologies can be used in models of predicting financial failure, financial fraud, stock markets, and quantitative modelling via decision trees, neural networks, and algorithms.

The study of (Rezaee, Dorestani, & Aliabadi, 2018), emphasized the significance of big data analytics for the accounting and auditing professions, as management can use big data and time-series analytics to predict net income, stock prices, fair value estimates, risk assessment, and financial fraud detection. The study gathered net income data from time series spanning 1982 to

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1994 to forecast net income from 1995 to 1997. The financial component (disclosed profits) has been used in big data (organized and structured data) and merged with non-financial and unstructured components such as image and governance data, social and environmental data, and social media with the goal of analyzing and transforming them into useful information. have predictive, feedback, and timeliness value. As a result, the researcher believes that big data analytics will improve the relevance of accounting information.

iii. Big Data and Reliability Characteristic

Big data analytics results in the completion of financial reports, improved risk prediction for the facility, achieving consensus among stakeholders, displaying hidden data in financial reports to reduce information asymmetry, and then improved financial report veracity (Al-Htaybat & von Alberti-Alhtaybat, 2017). As it analyses internal information such as discussions, meetings, and phone calls that cannot be shown in traditional methods, big data analytics offers data that allows accounting information verifiable and neutral, has faithful representation, and is moderately free of errors and bias.

Big data from the Internet, either in the form of sound, image, or video, is very important to Egyptian traders and investors since it is helpful and valuable when making rational decisions, such as buying or selling shares. Companies that disclose non-financial information (videos and images) in addition to financial reports can improve the quality of the investment concept, big data analytics has an impact on accounting and the accuracy of financial reports. According to the study, companies follow the big data analytics procedures used by other companies to maintain and expand their competitive advantages. Professionals in financial reporting are attempting to adapt to the hurdles of using and mastering new technologies and applications, along with enhancing their capabilities and skills in big data analytics.

iv. Big data and Comparability Characteristic

Through the detailed info given by big data analytics, big data analytics helps improve the comparability of the enterprise's sectors, the company's comparison for more than one financial period, and comparison to other competitors in other facilities, Halen Crofts, content advisor at

Koplan Company, every sector, from manufacturing to retrial and services, benefits from the opportunity to improve operational efficiencies, assess risks, and recognize advantages and weaknesses through big data analytics. As a result, the researcher believes that big data analytics improves the comparability of accounting information.

According to the above, big data analytics improves the qualitative characteristics of accounting information, thereby improving accounting information quality, which has a positive impact on the quality of financial reports.

As confirmed also by (Moll & Yigitbasioglu, 2019), big Data will help to develop and evolve efficient management control systems and financial strategies in managerial accounting. Big Data will improve the quality and relevance of accounting data, increasing transparency and stakeholder decision making. Big Data in reporting can help with the development and refinement of accounting standards, ensuring that the accounting profession continues to provide useful information as the dynamic, real-time global economy evolves. Thus, the coming section will provide a brief explanation of the impact of big data on measurement quality, accounting assumption, and disclosure requirements.

3. Big data and asset measurement and valuation

The valuation of business assets has long been associated with being a complicated process. Big data may strengthen the efficiency of accountants engaged in financial accounting and the preparation of general-purpose financial statements to recognize assets, their features, and conditions, as well as investment opportunities for assets and related products. This can enhance the quality of fair value accounting or allow for the development of new methods for valuing intangible assets, particularly those that are currently not recognized in accordance with accounting standards, such as customer base, brand value, human resources, or commitments. Fair market value is defined as the price at which an item should be sold between two willing buyers.

According to the Financial Accounting Standards Board (FASB), "fair value is the price that would be received or paid to transfer an asset in an orderly transaction between market

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participants at the measurement date" (FASB, ASC 255-10- 20). The fair market value system allows assets to appreciate or depreciate based on factors such as upkeep, improvements, and so on. Big data may have an impact on According, big data analysis is important in the analysis of extrabudgetary elements and can significantly influence the development of accounting practices and how they are disclosed. He stated that fair value accounting in the sense that big data on the fair value of assets and liabilities gathered from various sources can reduce subjective assumptions in fair value estimates.

Manufacturing companies keep inventory accounts for tangible property like raw materials, work-in-process inventory, and finished goods. Each inventory account is valued based on the cost of the inputs used to create the item that will be placed in that account. This is a continuation of the historical cost principle, which shows that the cost of a finished unit includes the cost of each component within the unit. Nevertheless, it must be concluded that the value of assets created within a company is solely based on the historical cost of its units. The question of which valuation method should be used for assets derived within a company that have no historical cost may be raised. This is the problem that faced by businesses that generate intangible assets from their operations face.

On common financial statements, goodwill is arguably the most significant intangible asset. Internally generated goodwill (IGG) is defined by academics as goodwill that has not been recognized through a sale. Internally generated goodwill is a company's intangible asset that results from distinct and unique management practices, brand images, customer relationships, and so on. The only difference between franchisee goodwill and internally generated goodwill is that the intangible asset's value has not yet been realized. In a business purchase transaction, goodwill refers to the benefits of a specific business that some may regard as a profitable venture. For example, a local entity may sell their business at a premium, indicating that their asking price is higher than what the business' financial statements show it is worth after adding up all of the fair market values of each asset and subtracting their liabilities. This additional cost

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borne by a customer is known as goodwill.

Consumer big data has evolved in the context of current accounting principles. Some may argue that data is tangible because it is stored in servers or other specific equipment, making it a tangible product. Others believe that data meets the criteria for an intangible asset, because it lacks physical substance, is distinct from goodwill, and can increase future economic benefits (Sidgman & Crompton, 2016). The valuation of any intangible asset is based on the expectation of increasing overall profits in the near future. If this did not happen, businesses would not be sold at a premium, resulting in goodwill, and companies would not invest in collecting massive amounts of consumer data.

Nevertheless, unless the data is purchased from a data aggregation firm, this value is not recognized in the financial statements of businesses. If this were the case, consumer data would simply be valued at the purchase price. Often, the business itself generates large amounts of consumer data, causing financial representation to be undermined as a result of these large unrecognized intangible assets. Financial markets are under-informed because of this practice of not recognizing identifiable intangible assets, that may also lead to misleading financial markets. (Sidgman & Crompton, 2016).

Furthermore, companies these days invest in intangible assets more than physical assets, most of which are not measured or shown on the balance sheet. As a result, traditional financial statements are becoming less useful for investors, with a widening gap between capital market indicators and reported enterprise earnings. Big data analysis may aid in the development of key value indicators for intangible assets to ensure accurate accounting measurement and recognition in financial statements. Regardless of accounting valuation and recognition, when indicators are appropriately disclosed to stakeholders in the notes or the annual reports, this may enhance their relevance for business and investment valuation purposes. (Lev, 2018).

Thus, accounting processes must be modified to include a broader range of data collection and data analysis activities, resulting in financial reports that incorporate more unstructured event information about customers that better reflects future economic value creation (Bhimani & Willcocks, 2014). Corporate reporting can change its approach and accelerate its transition to real-time reporting with an emphasis on possible future information content by introducing Big Data analytics (Al-Htaybat & von Alberti-Alhtaybat, 2017); (Krahel & Vasarhelyi, 2014).

4. The impact of big data on disclosure

Risk disclosure is an important corporate disclosure because it reveals the current and potential risks that firms face that could jeopardies their survival. Risk disclosure informs investors about the risks that may affect their investments, assists in assessing the firm's risk profile, and has considerable liquidity, investment, and financing implications by limiting agency and information asymmetry problems (Linsley & Shrives, 2006). (Abraham & Cox, 2007) (Ntim, Lindop, & Thomas, 2013). Managers must, however, evaluate and measure current and potential risks effectively in order to disclose high-quality risk information. Managers require both backward and forward data on threats and risks, as well as advanced risk assessment models. Big data has the potential to provide a huge amount of internal and external data.

In recent years, risk is usually discussed in relation to big data in terms of reputational, personal, and societal risks of obtaining data from multiple sources and taking decisions based on them. Big data can play a significant role in providing managers with massive amounts of internal and external risk data in real-time. Thus, data can be used for better risk assessment and measurement with advanced big data analytics. Overall, big data technology can help by improving the quality of various financial reporting types, such as social, risk, and integrated disclosures, and thus reducing information asymmetry. Accordingly, financial institutions can gain real-time insight into their risks by utilizing data science technology that integrates predictive algorithms to analyze big data associated with risk assessment.

According to (Griffin & Wright, 2015), big data analytics is an urgent issue and a real opportunity for accountants, and that there is no change in accounting and financial disclosure, but there is a change in the traditional methods of accounting information registration, collection, and analytics. The study also concluded that big data analytics has a huge impact on the future and accuracy of financial reports, as well as the improvement of accepted accounting principles, specifically on the disclosure of "off-balance-sheet assets" and fair value accounting.

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As a result, the researcher believes that big data analytics improves the reliability of accounting data.

(Chen, Mao, & Liu, 2014) presents a case study of how Alibaba Group uses big data in fraud risk management, claiming that Alibaba Group has a fraud risk management system derived from real big data processing and intelligent risk models. As a result, final risk information will be more accurate and consistent, and it will be available in real time. This has the potential to significantly increase the quantity and quality of risk disclosure. Future research may look into how big data affects risk disclosure quality as well as whether companies use big data to improve risk disclosure. Among the many challenges that big data raises, one of the most urgent relates to data reuse. Leading commentators in the fields of informatics and computer science argue that the data fueling big data practices in many settings is inadequately documented and disclosed. The nondisclosure of data's provenance and pedigree, they argue, impedes data reuse, which in turn can prevent innovative applications of the big data method.

Because this issue related to data disclosure is subtle, some clarification is still required. Leading Computer Science and Informatics commentators to extremely worry about a problem that extends beyond whether data is sufficiently disclosed or whether big data practitioners disclose their data-analysis methods. The issue that some commentators are most concerned about is that, in many cases, sufficient information is provided about how data is initially collected and prepared. Understanding where data comes from and how its stewards have organized and manipulated it can be crucial to its downstream reuse—the essence of the big data method. Some commentators believe that the issue of insufficient data disclosure jeopardizes the very future of big data.

4. The impact of big data on accounting estimates

The price that a company pays for an item becomes its related cost, and thus its "value" within the organization. This idea is based on the historical cost principle, which states that the value of an asset in a company's financial statements equals the price paid for the asset. Asset valuation, such as inventory and PPE (property plant and equipment), could shift from historical cost to far more current estimates of value. When compared to valuation based on information obtained using modern technology, FIFO, weighted average cost, measurement of historical cost of PPE, and annual accounting estimate of depreciation are all significantly inaccurate compared to valuation based on information that could be obtained using the modern technology. For example, sensor data from machinery could be used to charge depreciation expense for a period that more accurately reflects the asset's actual utilization and related benefits. (Vasarhelyi, ogan, & Tuttle, 2015); (Warren, Moffitt, & Byrnes, 2015).

Large stream of literature conducted an experiment to investigate how "big data analytics" or the impact of using big data information more heavily than traditional data, on an auditor's judgments. They discover that auditors who receive contradictory evidence from their firm's artificial intelligence (AI) system (rather than a human specialist) make smaller adjustments to management's complex estimates, especially when management develops their estimates using relatively objective (rather than subjective) inputs.

(Ding, del Pozo Cruz, Green, & Bauman, 2020), demonstrate that big data can significantly improve managerial fair value and loss estimates used in financial statement preparation. They stated that Big data can also be used by managers and auditors to help improve the accuracy of fair value accounting estimates or to inform on their quality. Specifically, using data from insurance companies on loss reserves (future customer claims) estimates and realizations, they support that big data loss estimates were superior to actual managerial estimates reported in financial statements in four of the five insurance lines analyzed.

iii. Conclusion

One of the most frequent discussions about the future of accounting and assurance is focused on technological developments and innovations that have the greatest potential to impact accounting practice. Many current accounting processes, such as expense management, invoicing, and account receivable and payable processing, are now carried out by machines

powered by artificial intelligence. There are widespread claims that in the long run, additional elements and segments of the profession will no longer require human labor and will be supplanted by robotics and artificial intelligence. Basic auditing tasks designed for entry-level positions and new entrants into the profession, such as vouching for recorded transactions and investigating the audit trail, will most likely be completely automated within the next decade.
This will be the result of continued development and adoption of technologies such as big data analytics and the expansion of the Internet of Things phenomenon by the accounting and assurance profession. Accounting professionals' future roles will revolve around performing comprehensive analysis and reporting to relevant parties using more sophisticated accounting information systems combined with data analytics and supporting technology such as robotics and artificial intelligence. The increasing digitization of the profession will have a significant impact on the skills and knowledge required of young graduates entering the profession. The researcher points that, after close reading of the present part, in the light of the previous discussed literature studies, it got to be evident that, even after all the efforts proposed by the standard setters to align the accounting nature with these recent advancements, yet many of these efforts failed to provide a genuine resolution to the non-stop complications associated with these recent technological developments.

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