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Accounting in the Big Data Era: A Literature Review

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Abstract

Due to the increasingly growing amount of information that came available through the telecommunications and computing technology developments, the concept big data became popular. Despite its novelty, the term big data has become one of the most discussed topics recently, it has affected many fields in general and the business sector in particular. This data will drive the transformation of processes and business models towards higher levels of quality and effectiveness, thus improving performance, adding value to enterprises and creating its competitive advantage. In light of this, this research aims to discuss the concept of big data and its attributes in a trial to enrich knowledge on this new topic. Accounting in the big data era has also been focused through reviewing the literature that has been classified by branches of accounting. The study illustrated that the concept big data is completely different from traditional data. It can be accurately defined using some properties which can be summed up as: volume, variety, velocity, veracity, and finally value. In accounting, the study illustrated that big data has a great impact through improving financial reporting, risk management, enhancing budgeting, and increasing the efficiency of the audit process. The study also recommended that Performance measurement is a major area in managerial accounting that can greatly benefit from big data and therefore needs further research.

Key words: Big Data Analytics, Accounting Branches, Literature Review



Research Problem

Big data is a widely used term that became an urgent issue after the advent of the digital lifestyle. Such data, if managed properly, can make an effective contribution to improving the operational efficiency of business organizations. Although big data has become a pressing issue today, there is uncertainty regarding what exactly it means. The big data concept can have various explanations. There is no unique definition for this concept. Therefore, in this study, we will concentrate on the big data concept and explain its characteristics in order to broaden our understanding of this new topic. The effect of big data on accounting was also included through a literature review. Literature is classified into five categories according to the branches of accounting to which it belongs.

Research Objectives

In light of the research problem raised in the previous paragraph, this research aims to discuss the concept of big data and its attributes in a trial to enrich knowledge on this new topic. Accounting in the big data era has also been focused through reviewing the literature that has been classified by branches of accounting (financial, managerial, tax, audit, and general conceptual studies).

Research Structure

In light of the research problem and its objectives, the research plan is divided into the following:

1. The age of big data
2. Literature related to Accounting in the big data era

First: The Age of Big Data

Big data phenomenon is the harvest of the digital revolution with its different aspects which include the proliferation of social media, cloud availability, physical devices and finally analytics software revolution. These aspects each with its own nature has combined to create enormous data sets usually referred to as "big data".

One of the first definitions of the concept big data has emerged by the McKinsey Global Institute (2011, p.1) which treats it as “ datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze this data”. According to this definition what is considered big data is a subjective matter, it didn't defined in terms of a certain amount of terabytes. The definition assumed that with the advancement of technology over time, what is considered big today will no longer be considered tomorrow.

The most comprehensive and widespread definition of the term big data is the definition provided by Gartner, the world's leading technological research and advisory company. Gartner defined big data as “ 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”. Through a closer look, the researcher notices that this definition consists of three main parts all of which interact with each other to provide a full image of the term big data which include:

- **Characteristics of big data (volume, velocity, and variety).**
- **Technological capabilities to store and process data (cost effective& innovative forms).**
- **The goal or value (enhanced insight and decision making).**

From researchers' perspectives, there are number of studies that have discussed the term big data (e.g. Vasarhelyi, M. et al.,2015; Warren, J. et al., 2015; Arnaboldi, M. et al., 2017; Sheng, J. et al., 2017;



Cockcroft & Russell, 2018). Numerous definitions of big data have emerged depending on the researchers' interest and purpose.

For example (Sheng, J. *et al.*, 2017, p. 98) introduced big data as “extremely large amount of structured, semi structured or unstructured data continuously generated from diversified sources, which inundates business operations in real time and impacts on decision-making through mining insightful information from rambling data”.

Through reviewing literatures related to big data, the researcher notice that there is a consensus that data is considered big when it is characterized mainly by three major features: high-Volume, high-Variety, high-Velocity, or what is known as the three V's (Wamba *et al.*, 2015; Gartner, 2016; Al-Barznji, K.& Atanassov, A., 2017). These unprecedented characteristics give the data a unique nature that challenges the capacity of traditional information system. These features can be expressed in some details as follows:

1.1. Volume

Volume is the primary attribute that needs to be considered when talking about big data. The concept big data itself is closely related to the size of data which is massive. (EY, 2014) admitted that, in big data era the amount of data being created is vast compared to traditional data sources. (Ask, U. *et al.*, 2016) referred to big data volume characteristic as a large amount of data that required a huge storage, while (Al-Barznji, K.& Atanassov, A., 2017) expressed it as data increase with exponential growth.

1.2. Variety

The next attribute of big data is its variety. (Ask, U. *et al.*, 2016) referd to variety attribute of big data as data produced from larger variety of sources, and cover multidimensional data fields. (EY, 2014) focused more in the way data was generated, they refer to big data variety as data comes from different sources whether produced by machines or human.

By looking at the previous studies (Vasarhelyi, M. et al., 2015; Ask, U. et al., 2016; Appelbaum, D.; Kogan, A. et al., 2017; EY, 2017), the researcher notices that the variety attribute of big data can be divided into two main aspects, namely: Variety in data sources and Variety in data formats, where the last is a result of the former.

In a general classification, (Meknane, S.& Makdam, Sh., 2018) classified big data sources as following:

- **Commercial sources** resulting from transactions between two entities
- **Sensors**, such as satellite, road and climate sensors and population density
- **Data tracking devices** from mobile phones, and the Global Positioning System GPS.
- **Behavioral data sources** such as number of searches and number of page views.
- **Opinion data sources** such as comments on social media (e.g. Facebook, Instagram, Twitter etc.).

Data can vary in formats from structured data to completely unstructured, so we have three formats or types of data: structured data, semi- structured data, and unstructured data as follows:

- **Structured Data**: data that can be expressed in an organized form (rows and columns) in the usual spreadsheet or relational database. This data is familiar to business, predictable, and systematic (Appelbaum, D. et al., 2017).
- **Semi- Structured Data**: text data with discernable patterns (e.g. Extensible Markup Language XML data & Rich Site Summary RSS feeds) (Elgendy, N. & Elragal, A., 2014). Semi-structured data is considerably easier to analyze than unstructured data but need more effort to be analyzed than structured data.
- **Unstructured Data**: data with no inherent structure that generated from variety new sources, and can be in the form of



text, PDF, images, videos, audios and RFID tags (Appelbaum, D. et al., 2017). According to (EY, 2017) the traditional data warehouses that founded depending on relational data bases are not suitable for such format of data. In big data era and according to the digital life aspects, there is a strong transform from structured data to unstructured data or the combination between both of them (Vasarhelyi, M. et al., 2015; Arnaboldi, M. et.al. 2017).

1.3. Velocity

The term velocity refers to the Frequency at which data is generated and delivered (Ask, U. et al., 2016). Big data velocity deals with data that being generated extremely fast. (EY, 2014) expressed big data velocity as "a process that never stops, even while we sleep". In other words, big data velocity refers to speed of data flow, this flow of data is continuing, enormous and from different data sources especially after the emerging of digital life and internet of things that provide thousands of data in a few minutes.

In addition to these three main characteristics (The 3V's), other researchers (e.g. Zhang, J. et al., 2015; Özköse, H. et al., 2015) discussed more big data attributes that have not been focused on compared to the previously mentioned 3V's. Those attributes include veracity and value. Where veracity refers to the quality of the data and value is the worthy insights and benefits generated through mining and processing available big data (Wamba et al., 2015).

Taken together, the concept big data is completely different from the traditional data. Although the term "big data" represents data generated in a huge amount, it doesn't refer to data volume only, but also including data that comes to you fast, frequently in a complicated format, and from a variety of sources. Accordingly, big data can be accurately defined using some properties, these properties can be summed up as volume, variety, velocity, veracity and finally value.

Second: Literature Related to Accounting in the BIG

Data Era

Big data is an extensively used concept that became a matter of urgency when digital life style appeared. According to the digital revolution and automation, enormous amount of data has generated each second. This huge amount of data of various types has generated a new challenge in all areas of life called big data. In accounting context, many researchers have argued that big data playing a greater role in accounting (Vasarhelyi, M. et al., 2015; Warren, J. et al., 2015;; Arnaboldi, M. et al., 2017; Kaya, I. & Akbulut, D. H., 2018; Rikhardsson, P. & Yigitbasioglu, O. , 2018; Salijeni, G. et al., 2019; Younis, N., 2020).

To organize this section of literature review, the researcher including studies that illustrate the effect of big data on accounting. The researcher classifies big data literature into four categories according to the branches of accounting to which it belongs (Financial Accounting, Managerial Accounting, Tax Accounting and Audit practice). A fifth category (general conceptual studies) were added as many literatures is general and can't be classified under the previously mentioned four branches.

2.1. Big Data and Financial Accounting

(Krahel, J. & Titera, W., 2015) explained that digital life supplied mechanisms that enable real time data generation and that many data types came to be quantifiable which must affect financial reporting presentation. The study revealed that financial reporting can be affected in big data environment through three aspects: using RFID in valuing inventory, using real time data in valuing fixed assets, and finally using predictive analysis in accounting estimation. The study also discussed the potential needs of different kinds of investors and the ability of big data to provide a suitable amount of data for those investors. The researchers recommended that accounting standards must be adapted



to include the continuous generation and transmission of huge amount of data rather than their presentation only.

(Kaya, I. & Akbulut, D., 2018) illustrated the impact of big data analytics on accounting and financial reporting. The study based on a qualitative method where interviews with accounting academics and professionals in different industries were held. Eight participants were interviewed during 2018. The study illustrated that in the age of big data analytics, the nature of financial reporting does not change, but the traditional methods of collecting, recording and analyzing accounting information alter. Furthermore, the study revealed that big data analytics become an urgent issue and a real opportunity for accountants, especially those working in forensic and valuation fields. Finally, regarding accounting professionals, the study recommended that they must improve their skills and capabilities in the areas of big data analytics to keep up with this revolution.

(Younis, N. (2020) investigated the influence of big data analytics on financial reporting quality in Saudi Arabia. The study also clarified the role of big data in transforming the accounting profession and accountants' roles. A field study based on questionnaire is conducted in the Kingdom of Saudi in 2019. The study results revealed a significant statistically effect of big data on improving the characteristics of accounting information quality, which in turn positively affect the financial reporting quality. The study also concluded that big data has an important role in achieving highly competitive advantages for business and providing relevant information to rationalize decisions making process within the organization as well as stakeholders' decisions.

2.2. Big Data and Managerial Accounting

The study of (Wang, Y. & Wang, Z., 2016) focused on the effect of big data and data mining on managerial accounting. The researchers conducting a SWOT analysis to show the strengths, weaknesses, opportunities and threats of using big data and data mining in managerial accounting. One of the main findings of the study is that big

data ecosystem can strengthened the managerial accounting functions in three main areas:1) management of cost, 2) performance analysis and evaluation, 3) planning and forecasting functions. These functions improvements play an important role in the process of decision making and therefore enhance the management capabilities. The study also revealed that technologies changed the way in which organization work, it has a substantial impact on organizations' strategy, process and business management methods.

The study of (Appelbaum, D. et al., 2017) illustrated that through big data environment, the function of management accounting was developed from the decision based on financial analysis and budgetary control to strategic attitude that concentrate on identifying and managing the key financial and non-financial drivers of organization value. One of the major contributions of the study is providing a suggested framework for management accountants to utilize data analytics in the enterprise systems which help in measuring the organization performance using the balanced scorecard. According to the proposed model, three forms of data analytics (descriptive, predictive, and prescriptive) are employed in the four sides of performance measurement in the context of the ERP system. The study also discussed a number of factors that contribute to the successful use and utilization of data analytics within the organization such as data quality and reliability.

(Rikhardsson, P. & Yigitbasioglu, O. , 2018) revealed that there is a quiet little number of studies focus on the effect of business intelligence and data analytics in managerial accounting. Furthermore, most studies are conceptual in general and don't discuss key issues in managerial accounting. The study confirmed that the perception of such developments in accounting field is still limited which is worrying, as this neglect the potential benefits on decision support and decision-making process. One of the major contributions of the study is its ability to highlight various theories that could be beneficial in studying the relation between business intelligence and managerial accounting like institutional theory, dynamic capabilities theory. Finally, the study



raised a question about whether business analytics should be compulsory in accounting courses?

(Elkmash, M., et al., 2021) explored the impact of big data analytics as a tool that could enhance the ability to measure customers' performance. The study theoretical framework was developed based on the integration of the diffusion of innovation theory and the technology acceptance model TAM. The study data was collected from 104 Egyptian accounting professionals through Web-based quasi-experiments. The study findings showed that using BDA to measure customer performance improves the ability of the organization to analyze unstructured data, lowers the cost of unstructured data analysis, improves the ability to handle customer problems speedily, reduces the time spent to obtain customer performance reports, and limits managers' bias when measuring customer satisfaction. Based on TAM , the study confirmed accounting professionals' acceptance of BDA (intention to use, ease of use and perceived utility).

2.3. Big Data and Tax Accounting

(Shukla, Y. et al., 2018) proposed a system that uses big data analytics techniques to identify the potential tax evaders based on the information from their tax payment. the system begins with pre-processing of available data to handle any incomplete or missing datasets, minimize ambiguities, and ensure accurate information for analysis. Then, the K-mean clustering technique is used to construct clusters of taxpayers with similar behavior. Using decision tree technique, each cluster is classified as either taxpayers with or without fraud. In the previously mentioned classification stage, the patterns of taxpayer behaviors are also identified. Based on these patterns, the artificial neural network is used and prospective fraudsters could be discovered based on the information given. Finally, the study confirmed that this system will assist in detecting tax fraudsters and improving understanding of their fraud habits, which help in fraud prevention.

(Atanasijević, J., et al., 2019) presented the preliminary findings of a joint research project between the Tax Administration of Serbia

and the Faculty of Sciences at the Novi Sad university. The project objective is to develop algorithms that help in detecting the risk of tax evasion using advanced big data analytics and Artificial intelligence based on machine learning. The study results confirmed the effectiveness of the proposed approach in improving the efficiency of tax control. In addition, the proposed approach will also allow for a positive effect to those taxpayers who are classed as low-risk in terms of tax evasion. Moreover, additional positive effects are anticipated according to higher self-reporting of risky categories. these categories may have a greater likelihood of being under field control and therefore identifying tax evasion.

2.4. Big Data and Audit Practice

(Salijeni, G. et al., 2019) explained the merge of big data and its analytics in the audit process through focusing on three subjects: 1) the influence of big data environment on the relation between auditors and clients; 2) the effect of big data technology on the audit process at its different stages; 3) big data challenges in audit. The study revealed that many audit clients are enthusiastic to allow their auditors to explore the benefits from big data analytics, while others are worrying about opening their systems due to data security concerns. These concerns affect the auditors' ability to reach data needed to apply big data analytics in the audit process. The study added that big data analytics tools can also help in applying broader audit range through full population testing rather than sampling.

(Tang, J.& Karim, K., 2019) noted that current practices for discovering financial fraud risk needs improvement, and that brainstorming process contribute in creation of ideas that improving the efficiency of audit process. Therefore, the study proposed a model for auditors which make them take advantages of big data analytics in all stages of the brainstorming process. Integrating big data into brainstorming sessions can increase the scale of information, enhance the results of analytics and facilitate the audit group's communication which affect the efficiency of fraud detection. The study also explained



that the whole audit strategy needs to be adjusted if big data analytics are decided to be included. The study illustrated that one limitation of the proposed model is the cost (cost of updating system and cost of data collection). The researchers announced that larger audit firms are more suitable to implement such model.

(Alrashidi, M., et al., 2022) indicated that big data analytics has acritical impact on audit procedures on all the audit process phases (accepting the audit task, planning the audit, evaluating the client's internal control system, running the analytical audit procedures, determining levels of materiality and audit risk). BDA assists auditors in comprehending the internal and external environment of the client, which in turn has an impact on the decision to or not accept the audit assignment. It also makes it simple for auditors to perform analytical procedures, estimate client inherent risks, and evaluate the effectiveness of internal control system. Finally, the study confirmed that BDA auditor capabilities should be developed since it helps in additional value creation for both auditors and their clients.

2.5. General Conceptual Studies

(Vasarhelyi, M. et al., 2015) provided a general framework for big data in accounting. The study showed that while big data offers many powerful opportunities in the fields of auditing, accounting and business management, this requires the emergence of new jobs in the era of automation and business intelligence. The study also recommended an increase in statistical as well as information technology content in the Accounting curricula. The study also illustrated that expansion in big data increase the accounting ability to:1) analyze detailed data instead of summary transaction, 2) utilize a huge variety of internal and external data besides financial data in analysis, 3) integrate social networks data into accounting measurements and audit process.

(Warren, J. et al., 2015) argued that using different formats of big data (audios, videos and text) improve accounting with its different branches. For managerial accounting, the study revealed that big data

technology can help develop and improve management control systems, customer satisfaction and budgeting process. For financial accounting, big data can help in complementing original documentation and providing accounting estimation. Finally, for fair value accounting, the study showed that since valuations process are subjective and based on quantitative besides qualitative data, therefore additional data that are made available through big data could offer historical evidence on determining a fair value and provide assertions about this valuation.

(Arnaboldi, M. et al., 2017) illustrated that one way of framing the role of big data in accounting is determining whether this data is an object or a process, it is also needed to determine whether technology-enabled networks are mean through which accounting practices take place or an accounting practice target. The study provided a framework consists of three themes through which the relation between big data and accounting practices can be interpreted including new performance indicators, information governance and decision-making process. The study also recommended that accountants must be a part of data revolution, as they could contribute to the decision-making process through critical thinking rather than automating this process.

Conclusion

The main aim of the study is to enrich the knowledge of big data phenomenon and review literature related to different accounting branches in the big data era. In light of that, the study concluded the following:

- The concept big data is completely different from traditional data.
- Although the term "big data" represents data generated in a huge amount, it doesn't refer to data volume only, but also including data that comes to you fast, frequently in a complicated format, and from a variety of sources.



- **Big data can be accurately defined using some properties which can be summed up as: volume, variety, velocity, veracity, and finally value.**
- **In the field of accounting, it is argued that big data has a great impact through improving financial reporting, risk management, enhancing budgeting, and increasing the efficiency of the audit process.**
- **Regarding reviewing literature, , we have noticed that most studies are theoretical in nature, while few of them provide empirical evidence regarding big data usefulness in the field of accounting.**
- **Although big data and managerial accounting practices are closely related, there has been little research on this relationship. Performance measurement is a major area in managerial accounting that can greatly benefit from big data and therefore needs further research.**

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