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The Assessment of Audit Evidence in Big Data Environment

A Field Study

**A Research submitted to obtain The Master's Degree in
Commercial Sciences (Accounting)**

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Abstract:

Purpose – This study aims to determine the impact of the Big Data (BD) environment on the audit evidence (AE) through a field study in the Egyptian business environment.

Design/methodology/approach – The field study was based on a questionnaire developed to ask about the impact of BD environment on AE. The questionnaire was directed to a sample of 385 items from each internal auditors and financial managers in firms that have a BD environment, auditors in audit firms, and academics in Egyptian universities. Kruskal-Wallis test, Spearman correlation analysis, and multiple regression analysis are run to test the hypotheses.

Findings – The findings reveal significant differences among questionees regarding BD environment and AE. Furthermore, the results conclude significant a positive correlation between BD environment and AE. Moreover, the study demonstrates a significant positive impact of BD on AE.

Originality/value – The current study provides a comprehensive overview of the literature on BD environment and AE, including its pros, cons, and implications for audit practice. In addition, it helps auditors better understand the business by providing them with more data, and the use of BD analytics to deal with BD, which results in providing a higher level of AE reliability, and audit mechanisms will benefit from information technologies, especially BD. Highlighting the development of traditional audit procedures and transforming them into automation to comply with the BD environment that dominates the business environment.

Keywords Audit Evidence, Big Data Environment, Big Data Analytics.

ملخص الدراسة:

الهدف: تهدف هذه الدراسة إلى تحديد أثر بيئة البيانات الضخمة على أدلة الإثبات في المراجعة من خلال دراسة ميدانية في بيئة الأعمال المصرية.

المنهجية: اعتمدت الدراسة الميدانية على استبيان صمم للسؤال عن أثر بيئة البيانات الضخمة على أدلة الإثبات في المراجعة، تم توجيه الاستبيان إلى عينة من ٣٨٥ مفردة من كل من المراجعين الداخليين والمديرين الماليين بالشركات التي تطبق بيئة البيانات الضخمة، المراجعين في مكاتب المراجعة، والأكاديميين في الجامعات المصرية. وقد تم استخدام اختبار كروسكال واليس، تحليل ارتباط سبيرمان، وتحليل الانحدار المتعدد لاختبار فروض الدراسة.

النتائج: تكشف النتائج عن وجود فروق معنوية بين آراء المستقصى منهم حول بيئة البيانات الضخمة وأدلة الإثبات في المراجعة. علاوة على ذلك، خلصت النتائج إلى وجود علاقة طردية بين بيئة البيانات الضخمة وأدلة الإثبات في المراجعة. علاوة على ذلك، توضح الدراسة وجود أثر إيجابي لبيئة البيانات الضخمة على أدلة الإثبات في المراجعة.

الأهمية: توفر الدراسة الحالية نظرة شاملة عن الأدبيات المتعلقة ببيئة البيانات الضخمة وأدلة الإثبات في المراجعة، بما في ذلك إيجابياتها وسلبياتها وأثارها على ممارسة المراجعة. فضلاً عن مساعدة المراجعين على فهم الأعمال بشكل أفضل من خلال تزويدهم بمزيد من البيانات، واستخدام تحليلات البيانات الضخمة، مما يؤدي إلى توفير مستوى أعلى من موثوقية أدلة الإثبات في المراجعة، وزيادة استفادة آليات المراجعة من تقنيات المعلومات، وخاصة البيانات الضخمة. بالإضافة إلى إلقاء الضوء على تطور إجراءات المراجعة التقليدية وتحويلها إلى التشغيل الآلي لتتوافق مع بيئة العمل التي تسيطر على بيئة الأعمال.

الكلمات الدالة: أدلة الإثبات في المراجعة، بيئة البيانات الضخمة، تحليلات البيانات الضخمة.

1. Introduction

Audit Evidence (AE) is all information that can affect the judgment and assessment of the auditor about the validity of the client's financial statements. AE are different types as physical examination, confirmations, documentation, inquiry, scanning, observation, recalculation, re-performance, and finally analytical procedures (Morariu et al., 2008; Çavdar, 2016).

Recently, due to a technological revolution, various technologies have emerged that can make changes in the environment and practice of both accounting and auditing. Big Data (BD) is one of those widespread technologies as it is a phenomenon in itself (Tang & Karim, 2017). BD refers to the massive volume of structured and unstructured data that organizations collect daily. This data is too large and complex for traditional data processing software to handle, which means that new tools and technologies are required to store, process, and analyze it (Bhadani & Jothimani, 2016).

BD has the potential to revolutionize many industries, as it plays a double-edged sword that BD can be used to discover hidden patterns and insights that were previously unknown, adopt modern tools in the auditing process, and thus achieve the required speed in implementing auditing procedures effectively with high quality, cost savings, time savings (Hezam et al., 2023). On the other side, it is considered a challenge because auditing faces some problems such as data acquisition, information overload, pattern recognition, information relevance, ambiguity, privacy, and security concerns, as data can be sensitive and significant (Yoon et al., 2015; Lee, 2017; Vanbutsele, 2018).

Nowadays, the digital domain creates new forms of data such as textual media, emails, videos, records, and other types of unstructured financial data with progressing sensor data (e-tracking) being gathered and captured by measurement and storage devices (Brown-librud & Vasarhely, 2015). In external auditing, BD may be conceptualized as an additional information resource that has a direct effect on increasing the understanding of the environment of the business client. Moreover, many entities process information electronically, such as electronic data

interchange with customers, suppliers, cash payment, and E-commerce. The documents of these transactions may only be available in electronic form. Thus, the traditional view of AE is not sufficient. So, by incorporating Big Data analytics (BDA) tools into the audit process. The audit profession and its regulators must consider the impact of the more advanced technological environment on some traditional forms of AE. The use of BD as additional evidence can be a valuable tool for auditors to improve the quality and efficiency of the audit process.

The main objective of the study is to examine the impact of BD environment on AE. Sub-objectives are formulated to achieve the main objective. Firstly, determining the differences among questionees in terms of the BD environment and AE. Secondly, investigate the relationship between BD environment and AE Thirdly; evaluate the impact of BD environment on AE.

This study contributes to the existing literature in several ways. Firstly, this study aims to create a dialogue concerning advanced auditing in light of a new developing data environment. Secondly, BD and AE are topics that influence and develop the environment and nature of accounting and auditing science. Thirdly, it focuses on how audit mechanisms will benefit from information technologies, especially BD. Fourthly; it analyses and recognizes the pros and cons of applying the technology of BD in the firms. Fifthly, it sheds light on the impact of BD on the forms of AE, the procedures for obtaining them, and how to assess and analyze them. Sixthly, it shows how BD can help auditors better understand the business by providing them with more data, automating tasks.

The remainder of this study is structured as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 describes the study methodology followed by the results and discussion in Section 4, and Section 5 provides the conclusion, recommendation, and points to future research

2. Literature Review and Hypotheses Development

2.1. Literature Review

2.1.1. AE Conceptualization

AE can be defined as the whole set of information collected and evaluated by auditors when deciding whether a firm's financial statements are stated by generally accepted accounting principles (AICPA, 2004, SAS No. 106).

The characteristics of AE are determined by two aspects. The first aspect is sufficiency which refers to the quantitative measure of the AE, where there are control factors determining the needed AE in the audit process: auditors' expectations about misstatements in the financial statements, the efficiency of the internal control, materiality, economic factors, and the client's activity (White, 2011). The second aspect is appropriateness which refers to the quality measure of AE and its relevance to a certain management assertion (White, 2011). Both concepts are interrelated, because there is a negative relationship between both sufficiency and appropriateness of AE. When, the quantity of AE needed decreases if the quality of AE obtained increases (Zuca, 2015).

AE can be classified into two groups, the first group is traditional AE which refers to all information that was prepared on punched cards and paper, and then stored on magnetic tapes, so it is mostly archival and internal. The second group is electronic AE made possible by the development of data technology and the integration of information systems. Information that is created, transmitted, processed, recorded, and/or maintained electronically can only be accessed using proper equipment and technologies like a computer, software, printer, scanner, sensor, or magnetic media (Brown-librud & Vasarhely, 2015).

2.1.2. BD Conceptualization

BD can be defined as the evolution of high-frequency digital data with the behavior of high in Velocity, Volume, Variety, Veracity, and Value, which is causing difficult for it to be efficiently processed, stored, and analyzed by traditional methods and technologies (Warren et al., 2015).

There are groups of characteristics of BD, which are considered dimensions of BD. This was initially known as the 3Vs (Volume, Variety, and Velocity) of the data. Later researchers found that only 3Vs were insufficient to describe and illustrate a massive phenomenon such as BD. So, the characteristics of BD have expanded to 4Vs, 5Vs, and even 10Vs. where the 10Vs are Volume, Variety, Velocity, Veracity, Value, Visualization, Variability, Validity, Volatility, and Vulnerability (Arora & Agarwal, 2018). Moreover, viability and viscosity are two additional dimensions of BD (Khan et al., 2018).

Following the prior literature, BD can be classified into three types. The first type relates to structured data that is organized in tables in the form of rows and columns according to pre-defined models and business rules such as Excel (Ohlhorst, 2012; Sharma & Kumar, 2016). Additionally, it is managed by database management systems such as Oracle and Microsoft Structured Query Language (Kshetri, 2016). Whereas, the second type relates to unstructured data which is not organized in tables and is stored in data warehouses, data lakes, or NoSQL databases (sites) (Yudowati & Alamsyah, 2018). Such as video, audio, and text messages (Maldonado et al., 2020). Moreover, the third type relates to semi-structured which falls between structured data and unstructured data, such as email (Maldonado et al., 2020)

2.2. Hypotheses Development

In this section, the literature reviews the related studies concerning both BD and AE, and the hypotheses are developed. Yoon et al. (2015) indicated that BD can be used as an additional AE. The findings showed that BD provides several advantages as an additional AE. It helps to identify unexpected patterns or trends that may indicate audit risks, and it contributes to improving the efficiency of the audit process. However, there are also some challenges associated with using BD as an additional AE. It can be difficult to collect and analyze BD, it may be subject to distortion or manipulation. BD can be a valuable tool for auditors. Therefore, it is important for auditors to be aware of the challenges associated with using BD as a complementary AE. The study recommended developing techniques to integrate BD with traditional

auditing, transfer information among clients in a secure and compliant manner, and solve privacy issues.

Additionally, Brown-librud & Vasarhely (2015) shed light on advanced audit thinking because of the new evolving data environment. The study concluded that BD can reinforce and change the nature, usage, and decision process related to AE. Also, it found that the characteristics used to determine sufficient, competent, and reliable AE may not be suitable. Because, BD technology brings evidence with different characteristics like (difficulty of alteration, credibility, completeness, evidence of approvals, ease of use, and clarity). So, those characteristics require more standards to evaluate the evidence. In addition sources and types of evidence are new, so that evidence may complement or replace traditional evidence.

Whereas, Appelbaum (2016) handled one of the most important issues related to reliable evidence derived from BD, namely the issue of data provenance. The study is based on a literature review and theoretical analysis. The results reported that Data provenance is a critical issue for ensuring the reliability of evidence derived from BD. External evidence from clients is traditionally considered more reliable than evidence from other sources. However, external BD sources may lack provenance and verification, especially if they are "messy" or complex. This can make it difficult for external auditors to assess the validity of the data and to obtain reliable evidence for some aspects of the audit.

Moreover, Vanbutsele (2018) discussed the impact of BD on Financial Statement Auditing (FSA). A questionnaire was conducted in the Belgian context targeting large audit firms such as EY, KPMG, and Mazars. The study concluded that BD improves the efficiency, effectiveness, and quality of FSA, leading to changes in the collection of AE, the timing of the audit, cost structure, competencies of the auditor, and standards. Additionally, BD affects phases of the audit enabling auditors to accumulate more data in the risk assessment phase, and track and record any exceptions in the analytical procedures phase. However, there are challenges that need to be addressed when integrating BD with auditing, such as data acquisition, information

overload, pattern recognition, and privacy and security issues. To handle these challenges, the study developed tools to extract data, pre-select data, apply privacy by design, and use secure servers.

Furthermore, Yadav (2020) aimed to study the impact of BD on AE and assurance levels. The survey was distributed to CPAs, bankers, CFAs, and other finance professionals working in several states in the United States using Qualtrics software. The study found that using BD in auditing can help auditors to provide a higher level of assurance. This is because BD enables auditors to test more transactions and data, use predictive analytics to identify risks more effectively and discover patterns and trends that may not be visible in small data samples. However, BD also raises some challenges for auditors, such as the volume and complexity of BD and the need to develop new skills in the field of BD and analytics.

In the same year, Maldonado et al. assessed the impact of the BD on financial auditing in the Portuguese context. Their analysis, conducted in October 2019 via a questionnaire distributed to Portuguese financial auditors, revealed that a significant number of audit professionals remain unprepared to deal with this transformative phenomenon. Incorporating BD into the audit process offers auditors a value-added proposition, but it is not without its challenges. Financial auditors must therefore prepare for these challenges by acquiring new technological skills and establishing multidisciplinary working teams to overcome the perceived weaknesses.

In addition, Wadesango et al. (2021) investigated the effects of adopting BD and its analytics on gathering AE. The findings showed that BDA can have a positive impact on AE by increasing the volume and speed of evidence gathering, improving the quality of evidence, and expanding the range of evidence that can be collected. The study also identifies some challenges that auditors face when using data analytics, such as the volume and complexity of BD and the need for new skills. The study recommends that auditors take steps to maximize the benefits of data analytics, such as investing in training employees on data analytics skills, updating policies and procedures to include the use of

data analytics, and working with clients to understand their data and identify how data analytics can be used for more effective auditing.

The objective of the study by Perera et al. (2021) was to explore the motivations and challenges of using BD and BDA in external auditing. The study was conducted on a sample of 150 external auditors in Sri Lanka. The results showed that the most common motivations for using BD and BDA in external auditing were to improve the efficiency and effectiveness of audits, to identify new risks, and to provide more insights to clients. The most common challenges were the lack of skills and knowledge, the high cost of implementation, and the lack of data quality.

Furthermore, Soliman (2021) investigated the impact of BD on AE by doing a field study in an Egyptian business context. Based on a sample of 133 questionnaires academic members and auditors in auditing offices. The results found that BD improves assurance quality and auditing services, and reduces the consuming time in finding AE. Both BD and BDA make drastic changes in the sources and nature of data. Thus, obtaining complete, reliable, and efficient evidence. The diversity of BD sources has a positive impact on the audit objective, the size of the audit sample, and methods of assessing evidence. Because methods of evaluating evidence in the light of the modern business environment represented by BD differ from traditional business environments.

Recently, Hezam et al.(2023) reviewed the literature on the use of BD and BDA in auditing. The study concluded that BDA is a promising technology that can significantly improve the effectiveness of auditing. It can help auditors improve their accuracy, efficiency, and quality of work by identifying anomalous patterns in data, automating tasks, and providing deeper insights into client operations. However, there are some challenges that must be overcome before BDA can be widely adopted in auditing, including the need for high technical skills among auditors, the need for BDA tools and software, and the need for auditing standards that address BDA. Overall, the study concludes that BD has the potential to revolutionize the auditing profession.

Moreover, Zhao & Wang (2023) aimed to develop a new financial auditing method based on BD and neural networks. The basic idea is to use neural networks to detect patterns in financial data that may indicate fraud or manipulation. A real dataset of financial data was used to train a neural network model. The model was tested on an independent test dataset, and the test results showed that the model is capable of detecting suspicious patterns in financial data with high accuracy. The study results suggested that the new financial auditing method based on BD and neural networks can be a useful tool for improving the efficiency and effectiveness of the financial auditing process.

Previous studies declared that BD can build a bridge between internal and external sources of data, which provides auditors with a comprehensive view of problems. BD updates auditing procedures by supporting learning capabilities, and automation instead of manual work to attain faster results and get better audit efficiency. BD is beneficial from using advanced methods in collecting data at an appropriate time. In addition, auditors need sophisticated BDA techniques to analyze data to gain insights and information that enable them to express their opinions. The studies agreed that characteristics of data have multiplied due to the emergence of BD technology, in addition to the advantages provided by BD, but there are many challenges facing auditors. BD is a part of AE, so it can complement or replace to traditional evidence.

Therefore, the study hypotheses can be formulated as follows:

H₁: There were insignificant differences among questionees regarding BD environment and AE.

H₂: There were insignificant relationships between the BD environment and AE.

H₃: The BD environment impacts insignificantly on AE.

3. Study Methodology

3.1. Study population and sample

The study population comprised internal auditors, financial managers, external auditors, and academics. The study population is unknown, so the study sample is calculated by the Cochran formula as follows (Ahmad & Halim, 2017):

$$n_0 = \frac{Z^2 pq}{e^2}$$

e Margin of error
p Population proportion
z Use Z Table

According to the Cochran formula, the sample consists of 385 items of the study population, The Response Rate of the Sample can be illustrated in table (1) below:

Table (1): The Response Rate of Sample

Manual questionnaires			Electronic questionnaires	Total
Number of questionnaires Submitted	Number of questionnaire Received	Number of the Valid questionnaires	Number of questionnaires Submitted, and valid	
90	80	77	308	385

Source: Statistical analysis results

The sample can be distributed according to the job, the scientific qualification, and years of experience in academic and auditing, this can be illustrated in tables (1, 2, 3) as follows:

Table (2): Distribution of sample according to the job

	Frequency	Percent
Internal Auditor	132	34.3
Financial Manager	70	18.2
Academic	67	17.4
External Auditor	116	30.1
Total	385	100.0

Source: Statistical analysis results

The results in table (2) indicated that internal auditor has a large number of respondents representing (34.3%) of the respondents. While the academic has the lowest number of respondents representing (17.4%) of the respondents.

Table (3): Distribution of sample according to the scientific qualification

Qualification	Frequency	Percent
Bachelor	181	47.0
Master	106	27.5
PhD	98	25.5
Total	385	100.0

Source: Statistical analysis results

The results in table (3) revealed that a large number of the respondents have a high level of education (Bachelor) which represents (47.0%) of the respondents. However, the (Master, and PhD) as they represent (53%) of the respondents.

Table (4): Distribution of sample according to years of experience in the academic and auditing

Years of experience	Frequency	Percent
less than 5 years	97	25.2
from 5 years to 10 years	173	44.9
more than 10 years	115	29.9
Total	385	100.0

Source: Statistical analysis results

The results in table (4) reported a high level of years of experience in academic and auditing, as (44.9%) of the respondents have from 5 years to 10 years of experience and have dealt with their profession for a reasonable period. Moreover, (29.9%) of the respondents have more than 10 years of experience.

3.2. Data Source

Data was collected by the questionnaire that was developed and directed to questionees of the study sample to ask about the impact of BD environment on AE. The questionnaire was divided into 2 major sections: Firstly, consists of general data that is the job, the scientific degree, and work experience. Secondly, consists of some questions according to the Five-Point Likert scale, as the reliance on the Likert scale can convert the descriptive data into quantitative data to be treated statistically in a simple way. The Five-Point Likert scale helps design the questionnaire list on five weights, thus Likert scale ranges from (1) Strongly Agree, (2) Agree, (3) Neutral, (4) Disagree, (5) Absolutely Disagree.

3.3. Variables Description

Independent variable (X) is BD environment that includes (27) statements, divided into (3) main variables. The dependent variable (Y) is AE includes (26) statements, divided into (3) main variables. In the same context, the study involved statements that express the relationship between independent variables and dependent variables includes (55) statements, divided into (8) main variables. Overall, the model consists of (108) statements. This can be clarified in the Figure(1) as follows:

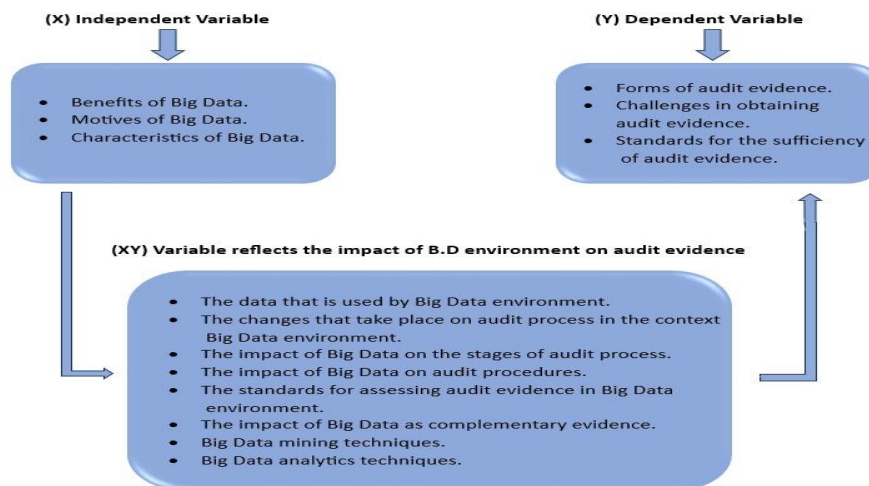


Figure (1): Variables description

source : The Researcher

3.4. Statistical Techniques

Many statistical techniques have been used in the study as follows: Descriptive Analysis, Cronbach's Alpha Test, Kolmogorov-Smirnov and Shapiro-Wilk Test, Kruskal-Wallis Test, Spearman Correlation Analysis, and Multiple Regression Analysis.

4. Testing Study Hypotheses

4.1. The Data Nature Tests

The extent nature of the study data for statistical analysis can be examined by testing the reliability and validity of study variables. Additionally, testing the normal distribution of study variables. This can be demonstrated as follows:

4.1.1. Testing Reliability and Validity

To determine the efficiency of the questionnaire, the study relied on the reliability and Validity of the questionnaire, which means that the same results of the measurements will be given in case of redistributing them at any time and under the same conditions. To test the reliability of the questionnaire, the study used Cronbach's Alpha test.

According to statistical standards, the value is accepted in case the desired limits equal or greater than 60% to apply the results to the study population. The validity was confirmed through the reliability coefficient, which is equal to the square root of the alpha Cronbach coefficient, it must be within the needed limit equal or more than 60% (Tavakol & Dennick, 2011). This can be illustrated in the table (5) as follows:

Table (5): Results of the reliability and validity test

Basic Axes of the Questionnaire	Coding	Number of statements	Reliability coefficient	validity coefficient
The most important benefits of BD environment	X ₁	12	0.823	0.907
The most important motivates for adopting a BD environment in the audit process	X ₂	7	0.773	0.879
BD environment has many characteristics, the most important	X ₃	8	0.733	0.856
The first axis: - The Nature of the BD Environment	X	27	0.643	0.802
The most important forms of evidence in BD environment are represented	Y ₁	9	0.793	0.890
The most important challenges facing auditors in obtaining evidence in BD environment	Y ₂	8	0.763	0.873
The most important standards for determining evidence sufficiency	Y ₃	9	0.803	0.896
The second axis: - The Nature of AE in BD Environment	Y	26	0.773	0.879
The audit in light of the BD environment depends on the following data	XY ₁	6	0.743	0.862
the changes that might be observed in the audit process due to BD environment	XY ₂	7	0.663	0.814
Reliance on BD in the stages of the audit process	XY ₃	5	0.703	0.838
Audit procedures are affected in BD environment	XY ₄	6	0.823	0.907
Evaluation of AE in the BD environment	XY ₅	8	0.872	0.934
The use of BD as new and complementary evidence for traditional evidence leads to many effects, the most important of which	XY ₆	7	0.821	0.906
Among the most important methods used in extracting AE in light of the impact of using BD	XY ₇	6	0.879	0.938
The most important methods used in analysing evidence in light of the impact of using BD	XY ₈	10	0.844	0.919
The third axis: - The impact of BD Environment on AE	XY	55	0.921	0.960
All items		108	0.919	0.959

Source: Statistical analysis results

The results in table (5) revealed that the value of the reliability coefficient for all study variables is (91.9%), and the reliability coefficient values for the main axes of the questionnaire are (0.643, 0.773, and 0.921) which are more than 60%. Moreover, the value of the validity coefficient for all study variables is (95.9%), and the validity coefficient values for the main axes

of the questionnaire are (0.802, 0.879, and 0.96) which are more than 60%. Therefore, the questionnaire has a high degree of internal reliability and validity, and the study can rely on it to achieve the objectives and popularize the results.

4.1.2. The normal distribution tests

For testing whether the study variables follow the normal distribution, the study relied on the Kolmogorov-Smirnov and Shapiro-Wilk tests. Where the variables follow the normal distribution if the significant value (Sig.) is more than 0.05 (Pallant, 2016). This can be clarified in the table (6) as follows:

Table (6): Results of the normal distribution test

Variables		Kolmogorov-Smirnov		Shapiro-Wilk	
		Statistic	Sig.	Statistic	Sig.
X ₁	The most important benefits of a BD environment	0.144	0.000	0.934	0.000
X ₂	The most important motivates for adopting a BD environment in the audit process	0.138	0.000	0.959	0.000
X ₃	BD environment has many characteristics, the most important	0.156	0.000	0.917	0.000
X	The first axis: - The Nature of the BD Environment	0.056	0.006	0.982	0.000
Y ₁	The most important forms of evidence in BD environment are represented	0.136	0.000	0.939	0.000
Y ₂	The most important challenges facing auditors in obtaining evidence in BD environment	0.135	0.000	0.935	0.000
Y ₃	The most important standards for determining evidence sufficiency	0.132	0.000	0.919	0.000
Y	The second axis: - The Nature of AE in BD Environment	0.049	0.028	0.980	0.000
XY ₁	The audit in light of the BD environment depends on the following data	0.201	0.000	0.909	0.000
XY ₂	the changes that might be observed in the audit process due to BD environment	0.130	0.000	0.907	0.000
XY ₃	Reliance on BD in the stages of the audit process	0.193	0.000	0.886	0.000
XY ₄	Audit procedures are affected in BD environment	0.164	0.000	0.904	0.000
XY ₅	Evaluation of AE in the BD environment	0.154	0.000	0.894	0.000
XY ₆	The use of BD as new and complementary evidence for traditional evidence leads to many effects, the most important of which	0.167	0.000	0.906	0.000
XY ₇	Among the most important methods used in extracting AE in light of the impact of using BD	0.179	0.000	0.899	0.000
XY ₈	The most important methods used in analyzing evidence in light of the impact of using BD	0.135	0.000	0.941	0.000
XY	The third axis: - The impact of BD Environment on AE	0.068	0.000	0.980	0.000

Source: Statistical analysis results

The results in table (6) indicated that the significance values for the Kolmogorov-Smirnov and Shapiro-Wilk tests were less than 0.05 which reflects that the study variables did not follow the normal distribution. So the study relied on nonparametric tests to prove the hypotheses' validity and achieve more accurate results.

4.2. Descriptive statistics

The study relied on the relative importance of the questionnaire items which can be determined according to the scale and numbers in table (7) as follows:

Table (7): Relative importance of the questionnaire items

Standard Average	Proportional Importance
From 1 to 1.79	Very Little
From 1.8 to 2.59	Little
From 2.6 to 3.39	Average
From 3.4 to 4.19	High
From 4.2 to 5	Very High

Furthermore, the study relied on descriptive analysis results that include mean and standard deviation to determine the trends of the sample, and to identify the proportional importance of statements that related to the BD environment and AE, as well as the least important ones. This can be illustrated in the tables (8, 9, 10) as follows:

Table (8): Descriptive statistics of the sample responses for the BD environment

	Statement	Mean	Std. Deviation	T- test	Proportional Importance
X ₁	The most important benefits of a BD environment	4.32	0.40	64.47*	Very High
X ₂	The most important motivates for adopting a BD environment in the audit process	4.20	0.45	52.29*	High
X ₃	BD environment has many characteristics	4.29	0.50	50.57*	Very High

Source: Statistical analysis results¹

The results in table (8) presented the descriptive statistics for variables that related to the BD environment. The most general agreement among the questionees was the important benefits of the BD environment, where the mean value (X₁) was (4.32) with a standard deviation (0.40). While, the lowest dimension was the most important motivation for adopting a BD environment in the audit process, where the mean value (X₂) was (4.20) with a standard deviation (0.45).

Table (9): Descriptive statistics of the sample responses for AE

	Statement	Mean	Std. Deviation	T- test	Proportional Importance
Y ₁	The most important forms of evidence in BD environment are represented	4.29	0.49	51.58*	Very High
Y ₂	The most important challenges facing auditors in obtaining evidence in BD environment	4.29	0.52	48.73*	Very High
Y ₃	The most important standards for determining evidence sufficiency	4.45	0.43	65.90*	Very High

Source: Statistical analysis results

¹ The T-test indicates the significance of agreement if the corresponding p-value is less than 5% significance level and the calculated T-test is positive. The T-test indicates the significance of agreement if the corresponding p-value is less than 5% significance level and the calculated T-test is negative. On the other hand, the referees the neutral when the corresponding p-value is greater than 5% significance level.

*Refers that the statistical test is significant at 5% significance level.

The results in table (9) presented the descriptive statistics for variables that related to the AE. The most general agreement among the questionees was the most important standard for determining evidence sufficiency, where the mean value (Y_1) was (4.45) with a standard deviation (0.43). While the lowest dimension was the most important form of evidence in BD environment, where the mean value (Y_2) was (4.29) with a standard deviation (0.49).

Table (10): Descriptive statistics of the sample responses for the relationship between the BD environment and AE

	variables	Mean	Std. Deviation	T- test	Proportional Importance
XY ₁	The audit in light of the BD environment depends on the following data	4.25	0.50	49.57*	Very High
XY ₂	The changes that might be observed in the audit process due to BD environment	4.17	0.67	33.92*	High
XY ₃	Reliance on BD in the stages of the audit process	4.35	0.52	50.61*	Very High
XY ₄	Audit procedures are affected in BD environment	4.29	0.59	43.23*	Very High
XY ₅	Evaluation of AE in the BD environment	4.37	0.56	47.80*	Very High
XY ₆	The use of BD as new and complementary evidence for traditional evidence leads to many effects	4.32	0.55	47.41*	Very High
XY ₇	The most important methods used in extracting AE in the light of the impact of using BD	4.26	0.60	40.82*	Very High
XY ₈	The most important methods used in analyzing evidence in the light of the impact of using BD	4.21	0.53	44.89*	Very High

Source: Statistical analysis results

The results in table (10) presented the descriptive statistics for variables that related to the BD environment and AE. The most general agreement among the questionees was the evaluation of AE in the BD environment, where the mean value (XY_5) was (4.37) with a standard deviation (0.56). While, the lowest dimension was the changes that might be observed in the audit process due to the BD environment, where the mean value (XY_2) was (4.29) with a standard deviation (0.67).

4.3. The differences among questionees in terms of the BD environment and AE

To examine to what extent there are differences among questionees in terms of the BD environment and AE. The study depended on the Kruskal-Wallis test that investigates the significance of differences in the mean among the questionees of the sample. A significance level lower than (0.05) will indicate the existence of significant differences among questionees regarding the BD and AE environment (Pallant, 2016). This can be illustrated according to the (Bachelor, Master, and PhD) by the table (11) as follows:

Table (11): Kruskal-Wallis test results in light of the scientific qualifications

Axes		Bachelor	Master	PhD	Chi- Square	P- value
X ₁	The most important benefits of a BD environment	176.95	214.58	199.31	8.14	0.017
X ₂	The most important motivates for adopting a BD environment in the audit process	184.84	188.94	212.46	4.16	0.125
X ₃	BD environment has many characteristics, the most important	184.50	191.56	210.26	3.49	0.175
Y ₁	The most important forms of evidence in BD environment are represented	186.20	220.58	175.73	9.70	0.008
Y ₂	The most important challenges facing auditors in obtaining evidence in BD environment	186.26	212.96	183.87	4.80	0.091
Y ₃	The most important standards for determining evidence sufficiency	187.65	203.39	191.65	1.38	0.501
XY ₁	The audit in light of the BD environment depends on the following data	169.79	214.83	212.24	15.58	0.000
XY ₂	the changes that might be observed in the audit process due to BD environment	165.46	216.26	218.70	21.50	0.000
XY ₃	Reliance on BD in the stages of the audit process	185.56	209.08	189.36	3.25	0.197
XY ₄	Audit procedures are affected in BD environment	178.56	223.02	187.20	11.37	0.003
XY ₅	Evaluation of AE in the BD environment	183.94	206.27	195.37	2.83	0.243
XY ₆	The use of BD as new and complementary evidence for traditional evidence leads to many effects, the most important of which	177.84	203.50	209.65	6.68	0.035
XY ₇	Among the most important methods used in extracting AE in light of the impact of using BD	173.30	209.47	211.58	11.11	0.004
XY ₈	The most important methods used in analyzing evidence in light of the impact of using BD	173.93	221.20	197.71	12.42	0.002

Source: Statistical analysis results

The results in table (11) showed that the significant level of (X_1 , Y_1 , XY_1 , XY_2 , XY_4 , XY_6 , XY_7 , XY_8) was (0.017, 0.008, 0.000, 0.000, 0.003, 0.035, 0.004, 0.002) respectively, which is lower than (0.05). Thus, there were significant differences among questionees in light of the scientific qualifications.

Additionally, the study can investigate the significance of differences in the mean among the questioned according to job by the table (12) as follows:

Table (12) Kruskal-Wallis test results in light of job

Axes		Internal Auditor	Financial Manager	Academic	External Auditor	Chi- Square	P- value
X_1	The most important benefits of a BD environment	189.33	191.85	195.18	196.61	0.30	0.960
X_2	The most important motivates for adopting a BD environment in the audit process	196.56	182.65	228.25	174.84	10.67	0.014
X_3	BD environment has many characteristics, the most important	204.38	189.24	215.85	169.12	9.78	0.021
Y_1	The most important forms of evidence in BD environment are represented	222.89	191.72	155.72	181.30	18.63	0.000
Y_2	The most important challenges facing auditors in obtaining evidence in BD environment	218.58	189.81	161.96	183.74	13.23	0.004

Y ₃	The most important standards for determining evidence sufficiency	190.80	162.81	200.37	209.46	8.18	0.042
XY ₁	The audit in light of the BD environment depends on the following data	203.00	186.64	191.02	186.61	1.78	0.620
XY ₂	the changes that might be observed in the audit process due to BD environment	214.98	179.01	209.46	166.93	14.47	0.002
XY ₃	Reliance on BD in the stages of the audit process	205.22	160.20	187.25	202.21	8.98	0.030
XY ₄	Audit procedures are affected in BD environment	223.49	192.23	180.96	165.73	18.20	0.000
XY ₅	Evaluation of AE in the BD environment	207.86	189.36	180.77	185.35	3.89	0.273
XY ₆	The use of BD as new and complementary evidence for traditional evidence leads to many effects, the most important of which	203.80	193.17	196.55	178.55	3.36	0.339
XY ₇	Among the most important methods used in extracting AE in light of the impact of using BD	207.44	209.83	200.07	162.33	13.37	0.004
XY ₈	The most important methods used in analyzing evidence in light of the impact of using BD	211.47	207.41	195.51	161.84	14.08	0.003

Source: Statistical analysis results

The results in table (12) showed that the significant level of (X₂, X₃, Y₁, Y₂, Y₃, XY₂, XY₃, XY₄, XY₇, XY₈) was (0.014, 0.021, 0.000, 0.004, 0.042, 0.002, 0.030, 0.000, 0.004, 0.003) respectively, which is lower than (0.05). Thus, there were significant differences among questionees in light of the job.

Moreover, the study can explore the significance of differences in the mean among the questioned according to experience years by the table (13) as follows:

Table (13): Kruskal-Wallis test results in light of experience years

Axes	Less than 5 years	Between 5-10 years	More than 10 years	Chi- Square	P- value	
X1	The most important benefits of a BD environment	193.14	197.48	186.15	0.72	0.697
X2	The most important motivates for a adopting a BD environment in the audit process	184.61	187.15	208.87	3.41	0.182
X3	BD environment has many characteristics, the most important	178.15	198.36	197.47	2.35	0.309
Y1	The most important forms of evidence in BD environment are represented	179.59	211.23	176.88	8.60	0.014
Y2	The most important challenges facing auditors in obtaining evidence in BD environment	173.60	210.61	182.87	8.35	0.015
Y3	The most important standards for determining evidence sufficiency	184.08	206.44	180.30	4.73	0.094
XY1	The audit in light of BD environment depends on the following data	163.15	211.95	189.67	12.66	0.002
XY2	the changes that might be observed in the audit process due to BD environment	170.01	204.23	195.50	6.12	0.047
XY3	Reliance on BD in the stages of the audit process	185.19	201.44	186.89	1.89	0.389
XY4	Audit procedures are affected in BD environment	178.13	207.23	184.13	5.46	0.065
XY5	Evaluation of AE in the BD environment	170.66	208.30	188.83	7.55	0.023

XY6	The use of BD as new and complementary evidence for traditional evidence leads to many effects, the most important of which	179.49	202.12	190.68	2.72	0.257
XY7	Among the most important methods used in extracting AE in light of the impact of using BD	175.68	208.52	184.27	6.65	0.036
XY8	The most important methods used in analyzing evidence in light of the impact of using BD	178.99	206.55	184.43	4.83	0.089

Source: Statistical analysis results

The results in table (13) showed that the significant level of (Y_1 , Y_2 , XY_1 , XY_2 , XY_5 , XY_7) was (0.014, 0.015, 0.002, 0.047, 0.023, 0.036) respectively, which is lower than (0.05). Thus, there were significant differences among questionees in light of experience years.

So as a result, there were significant differences among questionees in terms of the BD environment and AE in light of the scientific qualifications, job, and experience years. Consequently, it can be **rejected** the **first hypothesis (H_1)** related to "**There were insignificant differences among questionees regarding BD environment and AE**".

4.4. The relationship between BD environment and AE

The study relied on the Spearman correlation analysis to detect the relationship between a BD environment and AE, as this analysis aims to determine the direction and strength of the relationship between a BD environment and AE. This can be illustrated by the table(14) as follows:

Table (14): The relationship between a BD environment and AE

variables		Y ₁	Y ₂	Y ₃	Y
X ₁	Correlation Coefficient	0.286**	0.240**	0.339**	0.358**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
X ₂	Correlation Coefficient	0.193**	0.117*	0.276**	0.231**
	Sig. (2-tailed)	0.000	0.022	0.000	0.000
X ₃	Correlation Coefficient	0.260**	0.252**	0.341**	0.348**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
X	Correlation Coefficient	0.298**	0.268**	0.405**	0.401**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

Source: Statistical analysis results²

Table (14) illustrates the correlation Spearman, as there are positive correlation between the Benefits of BD (X₁), motives of BD (X₂), characteristics of BD (X₃), BD environment (X), and forms of AE (Y₁), as the correlation coefficients are (0.286, 0.193, 0.260, 0.298) respectively, at significant levels (P. value =0.000<0.05). BD is closely related to the forms of AE. Therefore, the more BD is available, the more AE is extracted from it. This evidence can be used to support making decisions. The multiplicity of BD characteristics works to increase the need for new forms of AE, the increase in the motives for using BD leads to an increase in the forms of AE.

Additionally, there are positive correlation between the Benefits of BD(X₁), motives of BD(X₂), characteristics of BD (X₃), BD environment(X),and challenges of obtaining AE (Y₂),, as the correlation coefficients are (0.240, 0.117, 0.252, 0.268) respectively, at significant levels (P. value =0.000, 0.022, 0.000, 0.000<0.05) respectively. This direct relationship means that despite the increase in the benefits of BD it creates several challenges for auditors, as the motivation for using BD increases and the increase of characteristics of BD, the need for new types of data also increases, creating new challenges in collection and analysis AE.

² The correlation coefficient with the two stars (**) can express the relationship at 1% significance level.

Furthermore, there are positive correlation between the Benefits of BD (X_1), motivates of BD (X_2), characteristics of BD (X_3), BD environment (X), and standards for determining sufficiency of AE (Y_3), as the correlation coefficient are (0.339, 0.276, 0.341, 0.405) respectively, at significant levels (P. value =0.000<0.05). The benefits of BD can lead to increased AE sufficiency, which can lead to improved audit quality. Motivations for using BD increase and the multiplicity of BD characteristics so the need for AE sufficiency standards meets these motivations. The multiplicity of BD characteristics leads to an increase in stringently defined AE sufficiency standards.

Likewise, there are positive correlation between the Benefits of BD (X_1), motivates of BD (X_2), characteristics of BD (X_3), BD environment (X), and AE (Y), as the correlation coefficients are (0.358, 0.231, 0.348, 0.401) respectively, at significant levels (P. value =0.000<0.05). Where Maldonado (2020) indicated that BD supplies auditors with massive amounts and sources of AE, and uses developed analytical tools to raise the value of new data and support making decisions. Yadav (2020) reminded that audit standards need to be updated to reflect the challenges of auditing in the digital era, also Auditors need better tools to deal with large amounts of data, and the responsible parties need to do more to ensure that audit standards are sufficient to address current needs.

To sum up, there were positively significant relationships between the BD environment and AE, consequently, it can be **rejected** the **second** hypothesis (H_2) related to “**There were insignificant relationships between the BD environment and AE**”.

4.5. The impact of the BD environment on AE

The study depended on the regression analysis for identifying the extent impact of BD environment on AE. This can be clarified by the table (15) as follows:

Table (15) Regression analysis results for the impact of BD environment on AE

Variables		Unstandardized Coefficients		T	P- value	TOL	VIF
		B	Std. Error				
X ₁	The most important benefits of a BD environment	0.316	0.046	6.831	0.000	0.807	1.239
X ₂	The most important motivates for adopting a BD environment in the audit process	-0.046	0.048	-0.951	0.342	0.600	1.667
X ₃	BD environment has many characteristics, the most important	0.239	0.039	6.056	0.000	0.714	1.401
Constant				2.143			
Durbin Watson				1.758			
R				.480			
R ²				0.230			
Adj.R ²				0.224			
F-test				37.997			
P-value				.000			

Source: Statistical analysis results

The results in table (15) exposed the results for assessing the accuracy of the regression model in testing the impact of the BD environment on AE. The values of the multiple correlation coefficient (R) reached (0.480), it was also noted that the values of (R²) that reached (23%) were in agreement with the values of the Adjusted R² that reached (22.4%). Moreover, the statistically calculated values of F-test reached (37.997). Also, the results documented that the regression models were highly

significant as the significance value was (0.000). In the same context, Durbin Watson test (1.758) indicates that there is no evidence that the error terms are not serially correlated where the calculated value falls in the range $dl^3=1.744$ and $du=1.755$.

In addition, the results in table (15) revealed that the most important benefits of BD environment (X_1), and BD environment has many characteristics (X_3) have positive and significant coefficients with AE (Y), as the regression coefficients were (0.316, 0.239) respectively, at significant (0.000, 0.000) respectively. While the most important motivates for adopting a BD environment in the audit process (X_2) has an insignificant impact on AE (Y), at significant (0.342).

This result showed that the benefits of the BD environment (X_1) and the characteristics of the BD environment (X_3) have a positive impact on AE. This was similar to that revealed by the study of Yoon et al. (2015) which discussed that BD provides complementary multi-types and sources of AE, outsourcing and cloud computing are new forms of evidence, continuous automated audit across applications that rely on BD. Moreover, Yoon & Kim (2015) referred that is a positive impact between the characteristics of BD and AE, as BD characteristics can lead to improved AE by increasing the quantity, changing the nature, and improving the quality of evidence. Also, Maldonado et al. (2020) stated that BD can help auditors to better assess risk and change the way of collecting AE as well as auditors are looking at ways to use BD from external and internal sources to better understand the client's business and identify potential problems. Furthermore, Wadesango et al. (2021); Soliman (2021) indicated that BD works to change the traditional view of AE. Therefore, there are methods of assessing evidence in light of the BD environment that differ from the traditional ways.

The following equation illustrates the main result obviously:

$$Y = 2.143 + 0.316 X_1 - 0.046 X_2 + 0.239 X_3$$

³ Dl is the lower bound and du is upper, the dl and du are greater from Durbin Watson table depending on the number of regressions (3) and sample size (385)

Overall, the most important benefits of a BD environment (X_1), and a BD environment has many characteristics (X_3) have positively significant impact on AE (Y). Accordingly, it can be **refused** the **third** hypothesis (H_3) related to "**The BD environment impacts insignificantly on AE**".

5. Conclusion

The study aimed to investigate the impact of the BD environment on AE. The study depended on a sample of 385 items from each internal auditors and financial managers in firms that have a BD environment, auditors in audit firms, and academics in Egyptian universities.

The findings reveal significant differences among questioners regarding BD environment and AE. Furthermore, the results conclude significant a positive correlation between BD environment and AE. Moreover, the study demonstrates a significant positive impact of BD environment on AE.

The study contribution can be demonstrated as follows. Firstly, this study is in line with the massive international interest in designing data "bridge" techniques to map and integrate BD with traditional AE. Secondly, highlighting the development of traditional audit procedures and transforming them into automation to comply with the BD environment that dominates the business environment. Thirdly, it requests to modify traditional auditing procedures to adapt to this evolving environment. Fourthly, it emphasizes the need to implement BD and BDA-based audit practices for audit firms as a means of improving audit quality and enhancing the efficiency of audits.

Furthermore, future studies can be conducted in terms of the impact of the change in auditing standards as a result of the change in both the technological environment and audit automation and its impact on the functions of the auditor. The impact of BD on audit data governance, behavioral implications of the impact of BD on auditor judgment and decision-making. The impact of BD on traditional auditing procedures and new procedures in light of the re-engineering of the audit process.

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