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A Proposed Framework for Big Data Analytics in External Auditing and Its Impact on Audit Quality with A Field Study in Egypt

Abstract

This research aims to explore the determinates of Big Data Analytics application (BDA) in external auditing, conceptualize the different contingent factors based on Technology–Organization–Environment Framework (TOE) and the perceptions of the audit firm, business clients, and some practitioner in Egypt regarding BDA and external audit practices and analyze the effects of these determinants on audit quality. To achieve this goal, contingency theory, analytical approach, and questionnaire with three different types of respondents are used.

The authors explore contingents' factors that trigger the application of BDA in different stages of auditing and analyzes its implications on audit quality. The study presents a few key results regarding the use of BDA in external auditing.

The authors recognize three groups of contingent determinates (TOE) and the conditions that govern the use of BDA will lead to improving audit quality elements (Input–Process–Output).

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Besides, the authors' emphasis on the relationship of the audit firm, business clients, experts in information technology, and regulators in motivating the use of BDA and improve audit quality.

The study specifies an attitude of external auditors that are likely to concentrate on using BDA techniques in audit engagement not only to achieve regulatory requirements but also to add value to business clients and the auditing quality three sides of the Iron triangle (efficiency/effectiveness/cost reduction and quality).

Moreover, some challenges restrict using BDA techniques in audit plans in Egypt such as audit firms' size, information systems infrastructure, and long-term audit engagements. The proposed framework can address the current issues related to the drives of BDA application and the empirical investigation of situational conditions that make BDA more relevant in external auditing in Egypt. Furthermore, the research discusses the phenomenon of BDA as one of the most recent topics in auditing. Moreover, it concludes the contingent determinates that make BDA more beneficial based on contingency theory.

Keywords: Big Data Analytics (BDA), Technology– Organization–Environment Framework (TOE), External Auditing, Audit Quality.

ملخص البحث

يهدف هذا البحث إلى بناء إطار مقترح لقياس أثر تطبيق تحليلات البيانات الضخمة (BDA) على جودة عملية المراجعة ولتحقيق هدف البحث تم اشتقاق محددات تطبيق تحليلات البيانات الضخمة في المراجعة اعتمادا على مدخل تحليل العوامل التكنولوجية - التنظيمية - البيئية (TOE) بالإضافة الى تحليل انعكاسات تلك المحددات على جودة المراجعة مع استخدام النظرية الشرطية والمنهج التحليلي. وقد تناول الإطار النظري مجموعة من النقاط أولا: مراجعة الادبيات المحاسبية السابقة واشتقاق خمسة فروض أساسية للبحث. وثانيا: استخدام أدوات (BDA) في المراحل المختلفة لعملية المراجعة. ثالثا: انعكاس (BDA) على جودة المراجعة. تم اختبار فروض البحث من خلال الدراسة الميدانية المعتمدة على استمارات الاستقصاء الموزعة على العديد من الفئات والتي تشمل أعضاء هيئة التدريس، المراجعين بمكاتب المراجعة الخارجية، المحاسبين الماليين والمحللين الماليين ، وتوصلت الدراسة الى قبول فروض البحث المرتبطة بأثر العوامل التكنولوجية والتنظيمية والبيئية على تطبيق شركات المراجعة واستخدام أدوات تحليلات البيانات الضخمة في المراحل المختلفة لعملية المراجعة مما يزيد من جودة عملية المراجعة والتي تم قياسها من خلال (المدخلات - التشغيل - المخرجات) ، ولقد انتهت الدراسة بتقديم العديد من التوصيات والمقترحات للبحوث المستقبلية.

الكلمات المفتاحية: تحليلات البيانات الضخمة (BDA)- العوامل التكنولوجية - التنظيمية - البيئية

(TOE) - المراجعة الخارجية - جودة المرجعة.

1. Introduction

There is an increasing recognition in the audit profession that the appearance of Big Data (BD) (Vasarhelyi et al.2015) as well as the developing the use of data analytics in the business process has brought a set of modern concerns to the audit community. This quick and exponential developing data and increasing accessibility to advanced technologies, together with the potential opportunities offered and risks posed by audit data analytics (ADA_s), have allowed audit data analytics to garner the interests of scholars, practitioners, regulators, and the auditing field. Large audit firms, academics, and standard setters have been accelerating many issues such as: Should modern analytics methods be used in the audit process? Which of these techniques are the most favorable? Where in the auditing process are these applicable? Should auditing standards be changed to permit/facilitate these techniques? Should the auditor report be more information? What are the competencies needed by auditors in the modern audit engagement environment?

Despite these issues, the amount of empirical and academic studies analysis and investigating the topic of BDA in auditing are limited. There is a lack of detailed recommendations in this age of BD and BDA regarding which analytical procedures to tackle in the external audit commitment. Despite the internal audit environment is increasingly using analytics (Vasarhelyi et al. 2015; perols and laugea, 2011). The regulations such as the guidance for sampling, have must unchanged even though many audit clients automate the collections (Schneide et al. 2017; Zhang et al. 2015).

The main purpose of this study is to gain insights into the role of BD and BDA and their implications for the audit profession. Then, identifying the factors influencing the use (or non-use) of BDA in every step in the auditing process based on the technology-organization framework (TOE) and explaining how to use every technique in different stages of the auditing process. In addition to that, the implications of BDA application on auditing quality. The study is primarily motivated by the claims showed that BD and BDA may transform and change the audit process and consequently allowing it to become more effective and efficient (Ey Reporting, 2015; Shukarova et al. 2017).To achieve this goal, this

field study undertakes a primarily inductive approach in investigating the subject using questionnaires as the principle data convection method. The application of BDA in the auditing process allows auditors to use unstructured data in sampling, financial fraud detection, and audit evidence. The larger information set, and more reliable evidence usually help ensure audit quality assurance measured by audit input, audit process, audit output, and the computer-based setting can reduce production blocking and redundant processes in auditing. To strengthen the practical contribution of the study, we suggest a framework that can be adopted by the audit team. We propose six steps system that includes initial data collection, data aggregation, fraud indicator identification, group meetings sampling audit evidence discussion, and recommendations. The framework offers an innovative and potentially effective approach of BDA application in the auditing process and its implications on audit quality.

The remainder of the paper is organized as follows: Section 2 presents a literature review and theoretical framework pertaining to BDA in external auditing, section 3 explains the used methodology while section 4 discusses research design and sample selection. The discussion and conclusion are presented in section 5 of this research. Limitations and further research directions are also provided.

2. Literature Review and Theoretical Framework

2.1 Literature Review of BDA Tools

Literature review can be divided into four trends as follows: The first trend of studies is related to the audit market in Egypt that is complex and competitive. Egyptian laws permit different types of audits. Both joint audit and dual audits are allowed. In some cases, a mandatory audit is required and few auditors use audit analytics in Egypt, however, audit analytics are more useful and increase the audit quality. Although many studies suggest that big audit firms provide higher audit quality in strict legal environments empirical evidence remains inconclusive. As little is known about the effect of the application of audit analytics on audit quality.

The American Institute of Certified Public Accountants (AICPA) defines Audit Data Analytics ADA, as “the science and art of discovering and analyzing patterns, identifying anomalies, and extracting other useful information in the data underlying or related to the subject matter of an audit through analysis, modeling, and visualization for planning or performing the audit” (AICPA, 2015). In addition, Zhang et al. 2015 focus on the gaps between BD and the current capabilities of data analysis in continuous auditing. BD contributes to the “sufficiency” requirement because of its volume and the variety of data provided on a real-time basis. Overall, BD is both promising and challenging for social research, as well as for the accounting and auditing areas. BD will improve the quality and relevance of accounting information, enhance transparency, allow decision-making by stakeholders, and using databases to replace historical values in balance sheets (Warren et al. 2015) and improve financial statement audits (Cao et al. 2015). There are four primary advantages of using DA on audits: (1) auditors can test a larger number of transactions than they do now; (2) audit efficiency will be improved by offering more insight into the processes of clients; (3) fraud would be easier to detect because auditors will use the methods and technologies they already use; and (4) auditors will offer resources and solve client problems (Earley, 2015). The auditors usually work with organized financial records, but the volume and the nature of businesses demand much faster and more advanced knowledge and analysis from both internal and external sources of unstructured or semi-structured non-financial BD. Moreover, as data-driven approaches become more prevalent, audit clients will probably see the use of BD techniques (Alles, 2015).

The second trend of previous studies is related to the factors that affect the use of BD. The use of BD and BDA in external auditing are discussed by Dagilienė and Klovienė (2019). They provide a detailed view of existing procedures and classify the driving factors into two classes (Company-related and institutional-related). They also discuss the circumstances in which to use BDA, contributing to the audit companies' desired outcomes. Moreover, they illustrate the relationship between audit firms, company clients, and regulators. The research shows a

trend whereby external auditors are likely to focus on procedures not only to meet regulatory requirements but also to add value for business clients. Industry structure has been investigated in several ways (Baker, 2012). Yudowati and Alamsyah (2011) provide a framework to incorporate the auditing process and the BD approach. Oliveira and Martins (2011) analyzed two popular models: Diffusion on Innovation (DOI) theory, and the technology, organization, and environment (TOE) framework. Based on the DOI model, they concluded the individual, internal and external characteristics of the organization are significant to its innovativeness. On the other hand, the TOE framework identifies three aspects of an enterprise's context including technological, organizational, and environmental contexts, which influence the process by which it adopts and implements a technological innovation. Furthermore, Rosli et al. (2012) developed a new I-TOE paradigm, which incorporated in Computer-Assisted-Auditing Techniques and Tools CAATT_s adoption in public accounting companies. They argued that acceptance of CAATT_s depends not only on the individual auditor acceptance but also on the management and technological character of the organization. There are other aspects that firms need to be taken into consideration besides looking at individual employee factor. These factors include the technological, organizational, and external environment of firms that may influence CAATT_s investment decisions. Based on only the environmental factors, the complexity of clients' accounting information systems (AIS) and perceived level of Professional Accounting Bodies (PABs) affect CAATT_s adoption. However, organizational factors, firm size, top management commitment, and employee IT competency are also significant aspects (Siew et al., 2020).

The third trend of previous studies is related to many analytical tools, which are utilized at all phases of the audit, but inconsistently. Appelbaum et al, (2018) classifies the most promising methods into audit examination(Ratio Analysis, Transaction Tests, Sampling), unsupervised (Predictive Process Discovery, Clustering, Visualization, Text Mining), supervised(Bayesian probability theory, Process Optimization, Fuzzy Artificial Neural Networks Regression: Log, Linear, Time Series), Regression(Log, Linear, Time Series, Multivariate Regression

Analysis, Univariate Regression Analysis) and Other Statistical Methods(Descriptive Statistics, Benfords Law, Monte Carlo Study/Simulations). Rose et al. (2017) concluded that the time of BD visualizations is an important factor in Data Analytics. They found that BD visualizations should be investigated after the traditional audit evidence because patterns in BD visualizations may be ignored by auditors if they investigated them earlier. Besides, they also deduced that BD visualizations in a later step provide a decision-making vision and improve both of audit planning and effectiveness. Rezaee et al. (2018) incorporated time series models in the BDA, which have an effective and efficient impact on accounting and auditing.

The fourth trend of previous studies focuses on the beneficial effect of BDA tools in improving the quality of the audit process. Audit efficiency and effectiveness are improved by the BD taxonomy (Krieger and Drews 2018) and the digitization of auditing derived by data analytics tools (Gray and Debreceeny 2014). Moreover, audit performance is not only improved by DA, Bende (2017) results show that audit professional experience with DA is an important factor to improve efficiency. On the contrary, Barr-Pulliam et al. (2020) proposed that the level of “reasonable” assurance achieved by traditional auditing techniques may not be greatly improved by BDA tools. Their study showed that the level of assurance and the financial statement users’ perceptions of audit quality is not improved by BDA tools.

The International Auditing and Assurance Standards Board (IAASB) in 2016 called for a review to the use of ADA by auditors to share good practices and continuous improvement of audit quality and documented that clients in some regions are increasingly inquiring about the use of data analytics and in some cases expect it to be used in audits (IAASB, 2016). The findings indicate that, in promoting BDA, audit firms are using various discursive strategies either to stimulate more public trust in auditors’ commitment to audit quality or to add value to their clients. BD enables auditors to analyze the processes that generate data (Salijeni,2019). Richins et al. (2017) argue that Big Data analytics complements the skills and knowledge of accountants and provides a conceptual framework

focused on structured/ unstructured data and problem-driven/exploratory analysis. Gepp et al. (2018) Given the well-developed literature on financial distress, modeling financial fraud, and stock market analysis, it's surprising that the auditing profession has been slow to adopt BD techniques. Anecdotal evidence from partners at some of the leading audit firms indicates that they have begun using BD. The review of the literature outlines a few key directions and possible BDA influences in the context of auditing. A major field research stream argues that the use of BDA is useful and valuable in ensuring the quality of the audit. From the above, the following hypothesis can be deduced:

2.2 The Theoretical Framework

2.2.1 The Determinates of BD and BDA Application

Using BDA may affect key levels of audit firms especially the audit role as a governance mechanism. Analytics will improve audit relevance in many areas: Not only allowing audit firms to extend their new services but also it improves audit quality mainly by analyzing all data's customers, Finally, with analytics, a new auditor profile emerges and the culture of innovation within audit firms will appear.

Thus, using analytics will improve audit firm governance and will make the manager's discretion any power will be limited. (Manita, 2020). Auditors will need to depend on BDA and technological techniques to perform this new role of the auditor in reducing the auditing expectations gaps. Its constants that the lack of credibility and assurance unstructured voluntary disclosures and BDA will affect the level of users' expectations towards the quality of these unregulated voluntary disclosures (Michael and Dixon, 2019). Auditors will need to rely more heavily on BDA and technological techniques to perform this modern role to close the auditing expectations gap.

BDA being an emerging technology is used in many business and management. Many determinants affect the usage of BDA adoption. By depending on (TOE) framework, is used in deducing the determinants of using BDA in audit firms. (TOE) the framework contributes to professional audit firms that need to

measure (BDA) acceptance. It outlines the three elements of a firm's context that affect the adoption and implementation of technological innovations, which are: (1) organizational context (2) environmental context, and (3) technological context (De pietro et al. 1990).

According to (Farid, 2019) that examined both the current use of audit data analytics among large audit firms in New Zealand, and the determinants of the use of audit data analytics fifteen semi-structured interviews were done involving seventeen interviews from six participating case firms. The advanced audit data analytics is perceived to be low, and the main differentiators of the use of audit data analytics between firms are the types of tools involved and firm structure. Using (TOE) framework as a tool in deducing the determinations of adoption of BDA as follows:

Table 1: (TOE) Framework as Determinates of BDA Application

TOE	Determinants
Technological Perceived Relative Advantage	A firm’s belief about the advantages of ADA _s relative to the use of more ‘traditional’ or manual audit methods.
Perceived Ease of Use	A firm’s belief about how easy it is to use ADA _s tools. Information related to the overall corporate information system, including the internal control system, financial accounting programmers and non-financial data programmers, databases and software used, level of computerization of business processes
Technological Capability	The technological competence of a firm and its people, and the state of its IT infrastructure. Information related to costs of creating and implementing BDA, including the financial resources needed Information related to the benefits of BDA, including advantages received, time efficiency, money savings and value for society by providing data that are more reliable Information related to the activities, capabilities and internal processes needed to prepare and use/analyze BD in a company such as IT with about infrastructure

<p>Organizational Structure</p>	<p>The way a firm’s structure may influence the use of ADA_s. Depending on the firm structure adopted by the related case, this determinant will be described according to one or more of the following specific structures: Centralized – The centralization of the firm’s ADA_s capabilities (e.g. ADA_s specialist team located only in the firm’s main office). Specialist – When a firm splits its ADA capabilities between two teams; an audit team and a specialist team that does not exclusively deal with ADA_s matters (e.g. the team may also provide analytics service to other service lines of the firm) Information related to understanding the client’s company and its environment, better evaluation of inherent risks and the control thereof</p>
<p>TOE</p>	<p>Determinants</p>
<p>Organizational Strategy</p>	<p>How a firm’s organizational strategy and actions put into place to achieve that influences the use of ADA_s. Information related to the corporate strategy and top management’s attitude/commitment to using BD and modern data analytic tools</p>
<p>Management Attitude</p>	<p>How a firm’s management views the use of ADA_s and the behaviors exhibited with regards to that. Information related to improvements in control and decision-making functions by using BD and BDA</p>
<p>Staff Acceptance</p>	<p>How a firm’s Staff views the use of ADA_s and the behaviors exhibited with regards to that. Information relating to the concept, understanding and duration of using BD/ BDA in a company Information related to the benefits of BDA, including advantages received, time efficiency, money savings and including advantages, received, time efficiency, money savings, and value for society by providing more reliable data</p>
<p>Environment Clients</p>	<p>How characteristics of a client, or a firm’s view of client perceptions of ADA_s , influences its use of ADA_s; the importance of activating the rules and corporate governance mechanisms for the audit client facility Information related to top management – government,</p>

	<p>foreign management, national shareholders, a global networking company Information related to the control of audit quality inside the audit company, as well as external public control Information related to the conditions needed to collect and implement BD such as the audit company’s size and the client’s size Information related to performing the audit, the application of analytical procedures and control tests, providing the auditor’s opinion, conclusion, continuous auditing instead of on a sample basis Internal control. When public interest companies are audited, the use of these tools becomes an essential element for assessing the control system and managing the audit risk:</p>
<p>Competition</p>	<p>How perceived competitive pressures influence a firm’s use of ADA_s. Information related to the competent audit team, employees and competence needed to work and use/analyze BD in a client’s company, being able to apply BDA Information related to the market structure (competition, oligopoly or monopoly) in the industry (both the audit company and the client), the influence of competitors on the decision to use BD</p>
<p>Regulators</p>	<p>How perceived regulatory pressures influence a firm’s use of ADA_s. Information related to the national regulative bodies and legal acts influence the use of BD</p>
<p>Audit Industry</p>	<p>How the nature of the audit industry and the pressures that it faces influences a firm’s use of ADA_s. Information relating to audit prices, which could be more competitive and easily Information relating to the increasing need for competent employees with business, IT and mathematical competence globally</p>

Source: depending on (Farid, 2019; Dagilienė and Klovienė,2019; Rosli et al.2012; Siew et al.2020)

In this study, researchers deduce the BDA determinates application that can be summarized in the following figure:

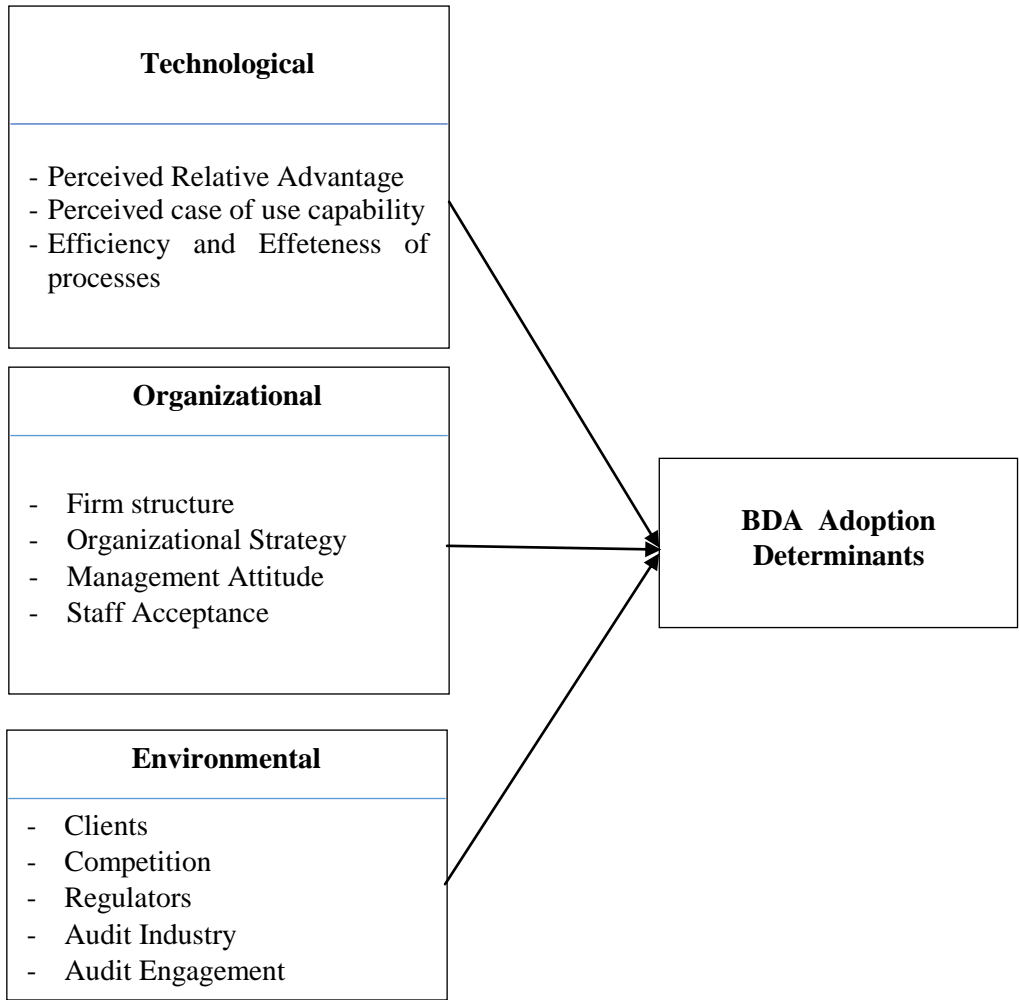
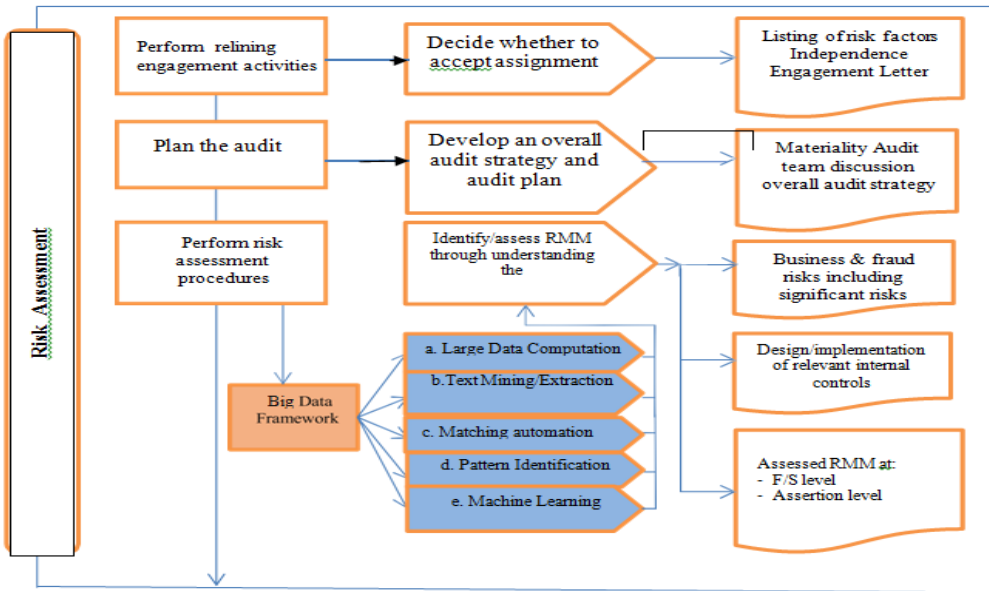


Figure 1: Determinants of BDA Application

2.2.2 Using BDA Techniques in Auditing Process

Generally, an audit is performed in four sections: First: planning and risk identification, driving this stage the auditor must understand the company, identify and decide what must be done to provide reasonable assurance. Second: the strategy and risk assessment, the auditor must determine what is the strategy of the company and assess the level of risks at the company. Third: is the execution, the auditor performs to check whether truthful and free of material misstatements. Fourth: conclusion and reporting the public accountant must perform its lasts procedures and make an official statement regarding its conclusion about the financial statement (Heyes, et al., 2014; Bender,2017). Cao et al. (2015) point out that using BD methodology is to provide a comprehensive and multidimensional view of incorporating BDA into the auditing process. The application of the BD framework provides a deeper understanding of the entity and its environment for risk identification Figure 2 provides a chart of the audit process after BD implementation.



Source: (Yudowati et al.; 2018)

Figure 2: The Audit Process after BD Implementation

The figure above demonstrates the application of the BD Framework (Processes a, b, c, d, and e) in the risk-based audit process at the risk assessment stage. When the auditor performs the analytical procedures, the auditor makes some analyses depend on existing information and take time to understand the entity being audited and assessing the risk of material misstatement in the financial report. After the application of BD methodology, the auditor can use in the assessment of risk procedures.

2.2.2.1 Using BDA in Risk Assessment

Incorporating BD in the framework of the risk-based audit process will require to perform risk assessment procedures from the auditor, all internal and external information is involved so that the evaluation of risk will be more structured and more comprehensive because more data will be involved and more capabilities will be used to find unexpected data patterns or insights will be used to find unexpected data patterns or insights. That can be shown in the table (2), (3) as follows:

Table 2: External Information Sources

External Information sources	Big Data External Information Sources	Identify Risks to Entities
The media and other external sources	Electronics news media and third party's analysis (CNN, detik, com)	Corporate governance risk, and poor reputation

Table 3: Internal Information Sources

Internal Information sources	Big Data Internal Information Sources	Identify Risks to Entities
Financial Reports	Company financial report last 3-5 years	Risk of sales value manipulation, profit presentation and financial ratios
Budget and Realization Report	Budget reports and periodic realization (monthly, semi-annual)	The risk of weak of internal control resulting inn over budget The risk of weak supervision on budgeting (inefficient)
Tax Report	Company tax report last 3-5 years	Risk minimize the tax burden

Ernst & Young (EY) states “Data Analytics, new technology and access to detailed industry information will all combine to help auditors better understand the business, identify risks and issues and deliver additional insights. In addition to the ability to review and analyses entire sets of data, rather than applying sampling techniques, will help bring more confidence to the audit”. The analytics will transform audit to expand beyond sample-based testing to include analysis of entire populations of audit relevant data using intelligent analytics to deliver a higher quality of audit evidence and more relevant business insights (Ramlukan, 2015); Tools of data analytics can test 100% transaction that will identify anomalies / unexpected patterns in client provided transaction data. This will guide additional test work, possibly uncovering fraudulent transactions judgment used in assessing the next steps after abnormalities are uncovered (Earley, 2015)

2.2.2.2 Using BDA in Audit Evidence

Alles (2015) suggests that to maintain credibility, auditors need to be aligned with the practices of their clients, however, the argument for auditors to only has used BD once clients. Statement of Auditing Standards No. 80, (SAS 80). Amendment to statement on auditing standard No. 31, Evidential Matter, was released to provide guidance regarding audit evidence collection in electronic environments (Auditing Standards Board) (ASB, 1996). SAS 80 shows that tests

of information technology (IT) controls, together with substantive testing, may provide sufficient evidence to form an audit opinion if the client's reliance on IT is so great that detection risk cannot be constrained with substantive testing alone (ASB, 1996). IT controls may be examined by inspection of log file activity for compliance verification most of the audit standards largely provide guidance related to traditional forms of audit evidence generated by the firm (PCAOB, 2010, As No. 15, AICPA, 2012; SAS, 122, SAS, 109). Although these standards do not sufficiently address the nature of audit evidence in an advanced technological environment.

Audit standards require auditors to collect audit evidence that is enough, competent, and reliable to support their audit opinion. BD contributes to the "sufficiency" requirement because of its volume and variety of data provided on a real-time basis (velocity). Because sufficiency stands on the risk of misstatement and the appropriateness (reliability and relevance) of the audit evidence collected (SAS No. 106, AICPA, 2004); more (less) evidence from BD is needed when it has lower (higher) reliability and relevance. BD can be quite reliable because it is often externally produced and required by auditors directly. Finally, the use of BD and BDA are often complementary to audit evidence some challenges face the application of BDA in choosing audit evidence, such as information privacy protection.

2.2.2.3 Using BDA in Fraud Detection

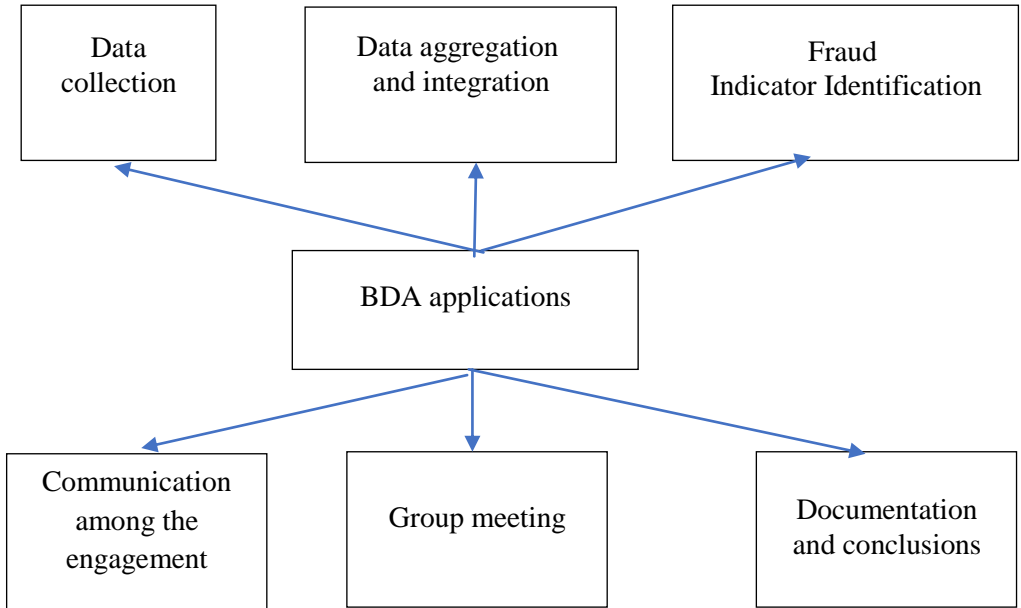
The modern trend is to use BDA for fraud detection. For example, using data mining techniques to explore patterns from journal entries to identify fraud (Debrecey and Gray, 2010). BDA can be used in identifying fraud risk, especially in the brainstorming sessions required by current auditing standards. In the early 2000s, an auditing statement (SAS, 99) was issued by AICPA. This standard specifically requires a brainstorming session to be done by auditors to identify fraud-related risks. Recently, the idea of brainstorming has been discussed to be added in multiple sections of the auditing standards. AICPA showed in AU-C 240 that

the engagement team is important to brainstorm and discuss areas probably subject to material misstatement, management's fraudulent reporting and asset misappropriation – AU-C315 of AICPA considers such matters as auditor's risk assessment activities similar requirement is also included in PCAOB standards (AS2110)

BDA can provide a solution to improve the performance of the brainstorming sessions. First BD expands the information based on Brainstorming. By involving, aggregating different types of information through BD tools, auditors can have access to the database that contains both financial (e.g. accounting record) and nonfinancial information (e.g. news on management, board meeting minutes, contact details, etc.) of the client firm. Second, BD can enrich the information content. When doing analytical procedures, auditors can efficiently compare data across time and industries to quickly identify anomalies. A larger sample data (or the full population) will also increase the accuracy of the prediction models. Thus, BD can generate reliable results that more precisely point to the fraud risks. Finally: BD can facilitate communications among the engagement team members or even between the predecessor and successor auditors for instance, during the brainstorming, sessions, auditors can use electronic devices to record their thoughts while reading other members' comments simultaneously. overall, the application of data big analytics in the sessions of brainstorming permits auditors to use unstructured data and analyze fraud factors closely related to the fraud triangle. The larger information set and more reliable evidence help ensure quality discussions and the computer-based setting can reduce production blocking and redundant processes (Tang and Karim, 2018).

Briefly, to deal with complexity in fraud detection and enhance effectiveness, different types of technologies are developed and implemented such as using data mining technologies finding pattern from records, to identify internal fraud risks, using outlier techniques to flag fraudulent, insurance claims, and applying natural language processing (NLP), queen genetic algorithm (QGA) and support vector machine (SVM) to analyze annual reports (Chen et al., 2017; Tang and Karim, 2018). Thus, BDA can enlarge the information size, strengthen the re-

sults from analytical procedures, and facilitate auditor’s communication. In addition to that and audit team can use BD tools at every step of initial data collection, data integration (Fraud Identification, group meetings, and conclusions and documentation. The role of data analytics in financial fraud detection can be summarized as follows in Figure (3).



Source: (Tang and Karim, 2018)

Figure 3: Using BDA in Fraud Detection

The techniques of BD that can be used in each phase of auditing are illustrated in table (4)

Table 4: Using BDA Techniques on Auditing Phases

Techniques	Audit Examination	Unsupervised	Supervised	Regression	Other Statistics	
Audit Phase	Engagement	Ratio Analysis	Visualization	Expert Systems/ Decision Aids	Log Regression	Multi-criteria Decision Aid
			Text Mining		Linear Regression	Structural Models
					Time Series	Descriptive Statistics
					Univariate and Multivariate	
Planning	Transaction Tests	Clustering	Process Optimization	Log Regression	Multi-criteria Decision Aid	
	Ratio Analysis	Text Mining	Expert Systems/ Decision Aids	Linear Regression	Descriptive Statistics	
	CAATS	Visualization	BBN	Time Series	Structural Models	
			Probability Model	ARIMA		
				Univariate and Multivariate		
Substantive & Compliance Testing	Transaction Tests	Clustering	Process Optimization	Log Regression	Multi-criteria Decision Aid	
	Ratio Analysis	Visualizations	SVM	Linear Regression	Bedford's Law	
	Sampling	Text mining	ANN	Time Series	Descriptive Statistics	

	CAATS		Genetic Algorithms	ARIMA	Structural Models
			Expert Systems/ Decision Aids	Univariate and Multivariate	AHP
			Bagging, Boosting		Monte Carlo Study
			BBN		
			Probability Models		
Review	Ratio Analysis	Visualizations	Expert Systems/ Decision Aids	Linear Regression	Multi-criteria Decision Aid
	CAATS		BBN	Time Series	Descriptive Statistics
			Probability Models	ARIMA	Structural Models
				Univariate and Multivariate	Hypothesis Evaluation
Opinion	Ratio Analysis	Visualization	Expert Systems/ Decision Aids	Log Regression	Multi-criteria Decision Aid
				Linear Regression	Descriptive Statistics

Source: (Appelbaum,2017)

2.2.3 The Impact of BDA on Audit Quality

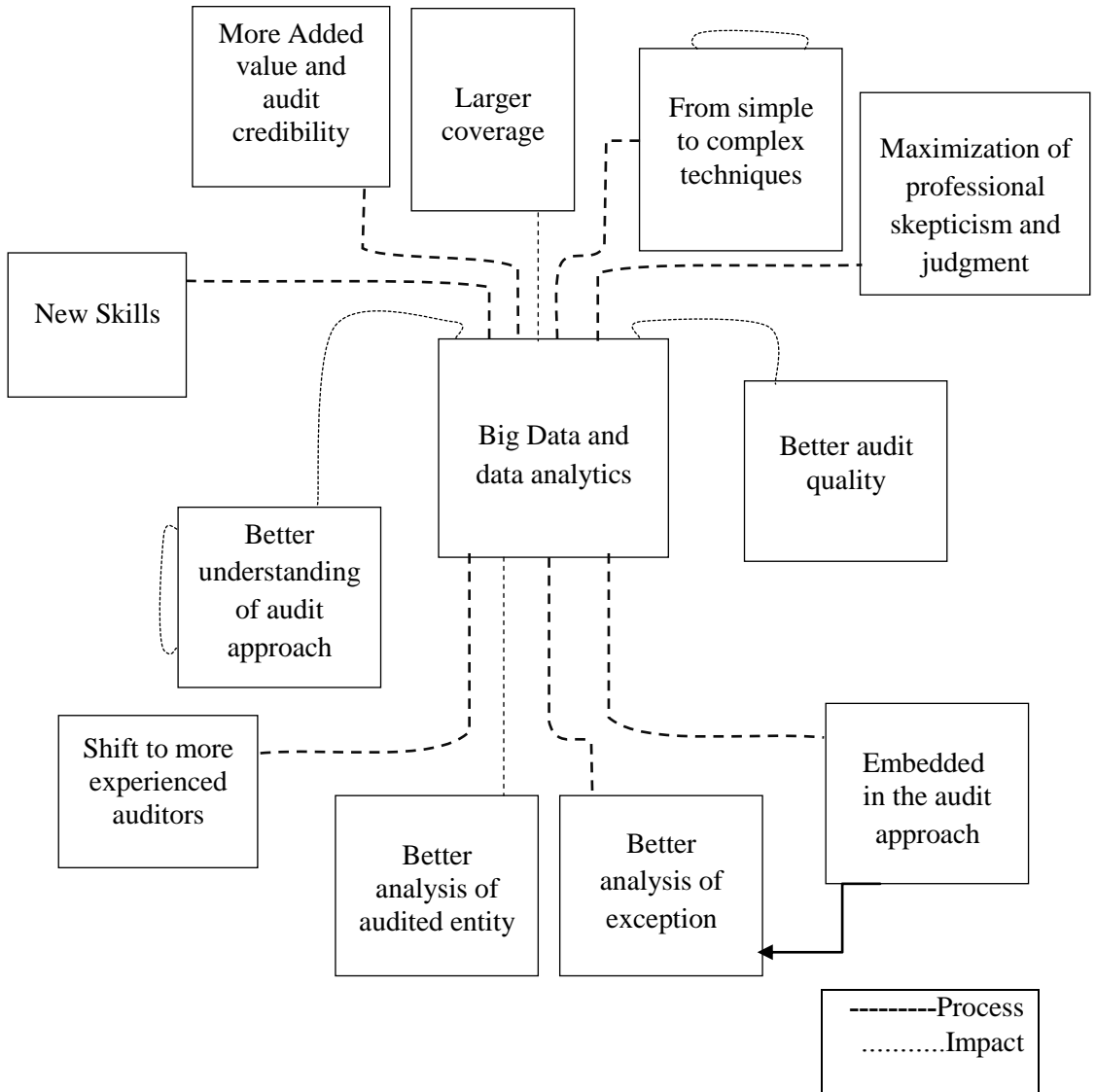
BDA as a modern enabler of competitive advantage (BDA) is considered as a game-changer enabling improved business efficiency and effectiveness because of its operational and strategic potential indeed, BDA is increasingly becoming an essential component of the decision-making process in business. BDA is now considered a major differentiator between high performing and low performing organizations as it allows organizations to become proactive and looking forward

to their decisions because BDA helps auditors to be able to use the tools with BD capabilities to improve the efficiency and effectiveness of audits (Early, 2015).

In addition, BDA will be necessary and enlarge the sufficiency, reliability, and relevance of audit evidence, which further quality (Alles, 2016). In these days, most of the audit firms are becoming digitalization, developing their internal processes, and studying how to exploit BD and new digital tools to add value to their customers and satisfy shareholders and other stakeholders by making the audit more relevant. First, with digital tools such as the analysis of BD, the auditors can evaluate all data of the audited firm and no longer use the sampling method, Second digitalization of audit processes enable them to improve risk assessment and quality of judgments by identifying the abnormalities and by proposing solutions to issue highlighted. Third, the audit could also focus on current data, and not just historical information, to give a prospective vision of such inability of the audited firm by evaluating the current level of sales, the planned order booking, etc., this additional analysis could significantly reduce the managers opportunistic and behaviors and thus enhance the audit relevance and improve the corporate governance (Manita, 2020) Fourth. Audit data analytic tools can analyze the entire population of accessible client transactions. While firms emphasize the potential benefits to audit efficiency and effectiveness, they caution that this approach provides no greater than the current level of reasonable assurance than does the traditional auditing techniques (Barr–Pulliam et al. 2020).

According to (Manita, 2020; Barr Pulliam et al. 2020), it is found that the usage of audit data analytics (ADA) tools increase perceptions of audit quality by improving two key elements of audit quality audit efficiency and effectiveness.

Thus, it is obvious that ABD can improve audit quality as figure (4) shows.



Source: (Santos, 2019)

Figure 4: BD, BDA and Audit Quality

To investigate the impact of BDA on audit work as well as the role and practice of contemporary auditing generally, three distinct analytical lenses of BDA can be used to explore the developments in BDA, namely technical, economic, and professional as follows:

Table 5: Analytical Lenses and Related Research Questions

Analytical Lens	Examples of research questions what is the impact of BDA on the delivery
Technical	
Impact of BDA on audit procedures and the reporting of the outcomes of audit? and on the achievement of audit quality?	
	<ul style="list-style-type: none"> -What is the extent to which BDA is genuinely reconfiguring the nature of the audit evidence? -Does BDA lead to truly transformational, innovative analytical procedures, or simply to increased subject to audit by means of conventional techniques? -Is BDA associated with more structured, routinized, and technique-oriented audit approaches? If so, -What is the potential impact of the rise of BDA on the exercise of professional judgment by auditors? -What impact does the rise BDA have on auditors actual and perceived ability to achieve audit quality, BDA producing better audits? -What should be the appropriate way for the audit regulators and standard setters to accommodate the current development with BDA and auditing into auditing standards and regulations?
Economic	
What role do the audit firms' strategies for the business impact of BDA on the economics of expansion and economics motivations play in auditing and the position of audit the promotion of BDA? Within multidisciplinary audit firm contexts	
	<ul style="list-style-type: none"> -What is the relationship between BDA and the cost of auditing? -What is the actual impact of BDA on the shifting boundaries between audit and non-audit services? -Is the audit function alone capable of generating resources enough for the development and management of BDA tools? Consequently, does BDA reflect purely an audit mindset?

	<ul style="list-style-type: none"> -What are the consequences of BDA for potential marginalization of auditing within audit firms’ service portfolios? -To what extent is the rise of BDA potentially contributing to a perception of audit as a supplier of knowledge spill overs for the audit firms; other service lines? -What are the effects of the claimed benefits of BDA (such as with regards to full population testing) on the scope of litigation against auditors?
<p>Professional</p> <p>Do auditors possess the expertise and knowledge impact of BDA on the notions of required for BDA environments? Accounting professionalism</p>	
	<ul style="list-style-type: none"> -Is the rise of BDA in auditing potentially altering the nature of skill sets required of a modern auditor (towards more technical competencies)? -Does audit practice in the era of BDA provides a suitable environment for the development of auditors as professionals? -What are the consequences of BDA for the image of audit work as intellectual inference – based practice? -Can the rise of BDA potentially generate significant deskilling and de-professionalizing effects? -Can BDA ultimately be judged as a destructive innovation (the prospect of an “auditor less audit”)?

Source: (Salijeni & Taddei, 2018)

From a technical view, the impact of BDA should be taken into consideration, so its effect on actual audit procedures is important, it's capacity to provide a means to enhance audit quality as it is can help auditors to detect material misstatements and report them to relevant stakeholders (Defond and Zhang, 2014). Further, from a technological view, BDA can help in drawing the technocratic image and question underlying assumptions such as the role of BDA in judgment and structure in audit work. It has been observed that BDA are technologies that are designed to offer guidance to auditors in making professional judgments from one hand. On the other hand, one can also make a counterargument that the additional insights generated using BDA tools need to be made sensual and inter-

preted by auditors and these sense-making endeavors ultimately require a degree of professional judgment. As noted, decisions around false positives or the nature and veracity of data brought to an auditor's attention using BDA. In addition to that BDA helps standard setters as included in the IAASB 2015–2016 work plan, IAASB, 2014a).

Finally, from an economic viewpoint, it has been found that the employment of BDA be relevant to the “business of auditing” potentially affecting audit costs and the efficiency audit work. It is used to differentiate and segregate between large and small audit firms. Audit data analytics allows auditors to gain a greater understanding of a client's operations and financial reporting process (Alles, 2015; Yoon et al. 2015) By facilitating auditor's conscious selection of relevant information cues and prevent irrelevant information cues (quality audit evidence), facilitating the selection of information cues and prevent irrelevant information cues (noise), overcoming the influence of gist information encoding by incorporating relevant information (both historical and current) to provide abstract output to auditors to ensure the selection of quality audit evidence and the risk assessment, competitive differentiation, quality, decision making and effective judgment (Ahmad, 2019).

As a result, the characteristics of data analytics appropriately have the capacity of users, it will enhance audit quality significantly by:

- It is the ability to visualize graphically results, data visualization is now a discipline.
- Complexity and the breadth of interrogation options.
- Ease of use by non-specialists and scale and speed, so that

(Bender, 2017) propose at least three different analytical viewpoints to examine BDA developments: technological, economic, and professional Conforms to the International Auditing and Assurance Standards Board's definition of audit quality, through three basic aspects: the inputs (auditing standards – characteristics of the auditor), outputs (auditor's report and contacts) and the context in which the audit process takes place (governance– law– reputation) (IAASB,–

2014). This research lists these quality measures data analytic tools increases perceptions of audit quality through three different analytical viewpoints the auditing process, Economics of auditing, and Professionalism and they are shown in the following table:

Table 6: BDA Increases Perceptions of Audit Quality

<p>Auditing Process</p>	<ul style="list-style-type: none"> -Improving the processing of audited information compared to traditional techniques -Making the best dealing with information processing weaknesses such as assessing the risks -Assist in using analytical procedures and increasing predictive -Increase the level of adequacy and relevance of the evidence -Influencing and disclosing audit results and increasing the need for real-time and electronic confirmation reports -Influencing the audit processes and providing an exhaustive picture
<p>Economics of Auditing</p>	<ul style="list-style-type: none"> -Influencing the audit facility's strategy to expand business, maintain competitive advantage BD is a powerful tool with high-quality predictive ability to define and adjust auditors 'expectations at the beginning of the "planning stage" - Increase the necessary investment support required in the process impact on the vision and role of the audit and understanding the facility under review and its environment
<p>Professionalism</p>	<ul style="list-style-type: none"> - Increase the nature of the skills, technical competencies and professional qualification Data processing and analysis requires more experience and knowledge of BDA environments -Reduces audit constraints, provide a higher level of assurance strengthening professional and organizational bodies through increase criteria and guidelines the ability to change the organizational structure of audit facilities and Auditors specialization - Retrieve relevant audit evidence from the use of (BDA) more efficiently

3- Research Methodology

Based on the literature review, the literature described several factors that can strengthen or pose a challenge to the application of BDA in external auditing by aggregating them in a theoretical framework as determinants of the application of BDA in different stages of the auditing process. Three participants are involved in the auditing process (Regulators, Audit company, and business clients). These contingent factors are determinants that are deduced based on TOE framework. These different contingent factors are determinates that may motivate the use of BDA, in external auditing theoretically. Qualitative research (Birkinshaw, et al. 2011) adopted the constructivist Ground theory. As explained by (Charmaz, 2006; 2014) This research uses the contingency theory for deducing contingent factors that determine the application of BDA in the auditing process and the analytical approach for measuring the impact on auditing quality Figure (5).

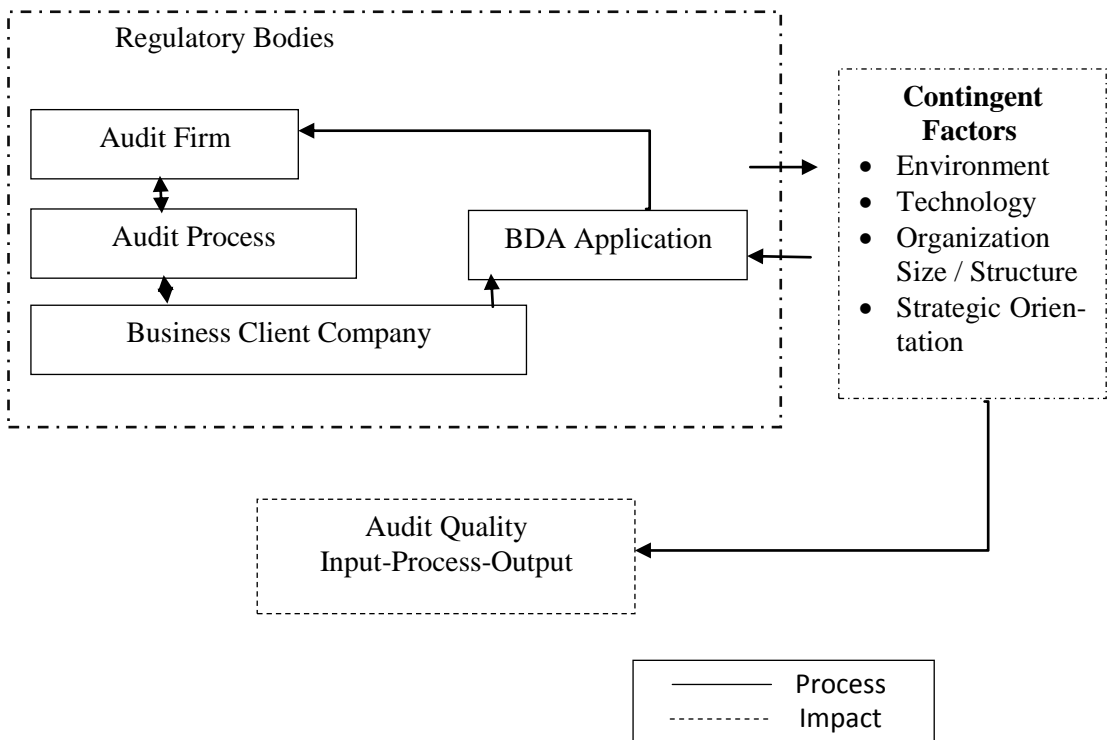


Figure 5: The Proposed Framework for Measuring the Impact of BDA on Auditing Quality

4 -Research Design and Sample Selection

This study is based on a questionnaire administered to the five groups (academics, external auditor, financial accountant, financial Analyst, and independent practitioners are classified as "other") see Appendix I, the sample should be reflective of various cultures, educational backgrounds, and empowerments. Data source and type were used by researchers to gather the necessary information from representative survey respondents and related sources. Data were analyzed from respondents using open-ended and closed-ended questioners using 5-point Likert scales (that are 5 strongly agreements, 4 agreements, 3 neutrals, 2 disagreements, and 1 strongly disagreements). therefore, the sample size will be divisible by the five categories which may result in selecting a sample of 159 respondents, by 88 questions split into six main aspects

- 1) The importance of BD
- 2) Technological factors
- 3) Organizational factors
- 4) Environmental factors
- 5) BDA tools used in the auditing process
- 6) Determinants of BDA application

Based on the literature review and theoretical framework ,the following hypothesis can be deduced:

H1: Technological determinates affect the application of Big Data Analytics (BDA).

H2: Organizational determinates affect the application of Big Data Analytics (BDA).

H3: Environmental determinates affect the application of Big Data Analytics (BDA).

H4: BDA techniques are effectively applied in different audit process stages in auditing firms in Egypt

H5: Implementing BDA improves the audit quality in the auditing firms in Egypt

4.1 Model Statistical Tests

The basics data were collected and analyzed by using version 23 of SPSS and presented systematically using descriptive statistics and the model of factor analysis, The Kruskal–Wallis test calculates an average rank of the responses from the participants to examine the difference between the groups. Results in Table 7 indicate that The current occupation of the study participants is as follows: 65 (40.9%) academics, 19 (11.9%) external auditor,12 (7.5%) financial accountant, 38 (23.9%) financial analyst, and 25 (15.7%) are classified as "other". As regards their qualification level, 49 (30.8%) were Bachelor, 47 (29.6%) were M.A. and the 34 (31.4%) were Ph.D. and 13 (8.2) classified as "other qualification". Years of Experience. Of the total respondents, 47 (29.6%) had less than 5 years of experience, 41(25.8%) had from 5 and 10 years of experience and had from 10 and 20 years of experience the remaining 30 (18.9%) had more 20 years of experience within the organization.

Table 7: Position of Respondents

Background of Respondent		Frequency	Percent
Occupation	Academics	65	40.9
	External auditor	19	11.9
	Financial Accountant	12	7.5
	Financial Analyst	38	23.9
	Others	25	15.7
	Total	159	100.0
Qualification	Bachelor	49	30.8
	M.A.	47	29.6
	PhD	50	31.4
	Other	13	8.2
	Total	159	100.0

Years of Experience	Less than 5 years	47	29.6
	5-10 years	41	25.8
	10-20 years	41	25.8
	More than 20 years	30	18.9
	Total	159	100.0

4.2 Hypothesis Testing

Based on the results of integrity and reliability of the importance of BD, technological factors, organizational factors, environmental factors, BDA tools used in the auditing process and determinants of auditing quality have Cronbach's Alpha value greater than 0.6 , it can be stated all the variables in the research is reliable. This means that all statement items are declared valid. The normality test results in this study indicate that the value of Asymp. Sig. (Kolmogorov Smirnov) is less than 5% and It can be concluded that the overall data used in this study is non-normally distributed. So, it can be used as the nonparametric test.

Table 8: Reliability Statistics

	Cronbach's Alpha	N of Items
The Benefits	.864	8
Technological Factors	.834	13
Organizational Factors	.811	11
Environmental Factors	.861	13
Tools	0.947	26
Quality	.929	17
All	.971	88

Table 9: The Benefits / Challenges Associated with BDA

	Academics	External auditor	Financial Accountant	Financial Analyst	Others	Kruskal-Wallis H	Asymp. Sig.	Mean	Std. Deviation
B1	79.58	81.58	82.25	88.43	66.00	4.59	0.332	4.38	0.64
B2	78.78	95.74	74.42	77.67	77.44	3.31	0.507	4.29	0.65
B3	89.98	87.68	62.38	76.34	62.24	10.56	0.032	4.10	0.93
B4	85.58	89.34	56.96	80.03	69.42	7.37	0.117	4.23	0.76
B5	85.46	98.74	67.00	74.34	66.40	9.23	0.056	4.21	0.76
B6	87.05	82.84	83.33	72.80	68.86	4.92	0.296	4.29	0.71
B7	86.22	84.11	73.88	84.11	57.42	9.13	0.058	4.21	0.84
B8	83.34	89.32	73.71	77.96	70.36	2.99	0.559	4.23	0.78
KMO and Bartlett's Test									
Kaiser-Meyer- Olkin Measure of Sampling Adequacy.								0.901	
Bartlett's Test of Sphericity					Approx. Chi-Square			470.849	
					df			28	
					Sig.			0.000	

Table 9 presents the results obtained for questions of the benefits / challenges associated with BDA using Kruskal-Wallis Test to determine whether there is a difference in the perception of academics, external auditors, financial accountants and financial analysts and others. the average rank for all the questions in the questionnaire suggests no statistically significant difference in the responses obtained from the participants in the groups (Asymp. Sig.>5%) except the questions of Testing complete sets of data instead of taking sample testing (Asymp. Sig.<5%) as the average of is greater than 4 The Std. Deviation for all expressions is less than one, so that the trends of the research sample items tend to agree on the importance of most of the item. Factor analysis model the results showed that the Bartlett test for the data were 0.000 which is less than 0.05. Thus, the result revealed that the factor analysis is significance at less than 1%. In general, the Kaiser-Mayer Olkin of 0.901 (that is 90%) and Bartlett test of 0.00 showed that the components is appropriate and significant at less than 1% level of significance. The results showed that the most important variables are Assisting them in risk assessment through identification of anomalies and trends, and comparison with

industry data and Sound judgment on clients“ going concern issue then the least testing complete sets of data instead of taking sample testing.

Table 10: Technological Factors

	Academics	External Auditor	Financial Accountant	Financial Analyst	Others	Kruskal-Wallis H	Asymp Sig	Mean	Std. Dev.
MT1	78.67	98.18	58.63	88.80	66.52	9.375	0.052	4.10	0.52
TA1	82.54	80.55	54.88	90.24	69.48	8.675	0.070	4.07	0.84
TA2	80.07	95.68	66.58	81.62	71.88	5.041	0.283	4.09	0.73
TA3	73.92	102.47	74.96	85.46	72.86	8.810	0.066	4.14	0.74
TA4	79.68	89.03	61.63	86.63	72.72	5.059	0.281	4.09	0.82
MT2	70.84	93.34	82.17	93.80	71.66	8.528	0.074	4.23	0.76
TE1	71.74	82.39	75.67	90.30	86.08	5.257	0.262	3.97	0.80
TE2	75.01	84.03	64.54	92.63	78.14	6.238	0.182	4.35	0.58
TE3	77.37	99.71	84.88	86.74	59.28	11.461	0.022	4.42	0.63
TE4	74.12	87.95	71.17	91.39	76.16	5.368	0.252	4.28	0.69
TE5	70.43	86.95	82.13	87.75	86.80	5.768	0.217	0.99	0.11
TE6	81.73	88.24	98.83	80.37	59.64	8.998	0.061	4.10	0.52
MTC	72.68	88.68	73.63	94.96	72.74	7.806	0.099	4.07	0.84
TC1	70.52	84.66	86.13	90.95	81.54	6.737	0.150	4.09	0.73
TC2	76.64	89.45	64.83	92.99	69.10	8.280	0.082	4.14	0.74
DEP_TECH	81.00	81.00	67.75	81.00	81.00	24.656	0.000	4.09	0.82
KMO and Bartlett's Test									
Kaiser-Meyer-Olkin Measure of Sampling Adequacy						0.817			
Bartlett's Test of Sphericity	Approx. Chi-Square					616.460			
	df					66			
	Sig.					0.000			

Table 10 presents the results obtained for questions of the influence of the technological factors associated with BDA. Based on the results of the Kruskal-Wallis Test the average rank for all the questions in the questionnaire suggests no statistically significant difference in the responses obtained from the participants in the groups (Asymp. Sig.>5%) except the questions of testing complete sets of data instead of been several steps in a process and the questions of the influence of the technological factors in using BDA tools (Asymp. Sig.<5%) that mean there is a difference in the perception of all groups in the simple . the average is greater than 4 The Std. Deviation for all expressions is less than one so that the trends of the research sample items tend to agree on the importance of most of the items. The results of factor analysis showed that the Bartlett test for the data was 0.000 which is less than 0.05. Thus, the result revealed that the factor analysis is significant at less than 1%. In general, the Kaiser-Mayer Olkin of 0.817 (that is 82%) and Bartlett test of 0.00 showed that the components are appropriate and

significant at less than a 1% level of significance. The results showed that the most important variables are overcoming human cognitive limitations and comparison with industry data and greater efficiency and effectiveness of work processes from using ADA then the least overcoming human cognitive limitations.

Table 11: Organizational Factors

	Academics	External auditor	Financial Accountant	Financial Analyst	Others	Kruskal-Wallis H	Asymp. Sig.	Mean	Std. Dev.
MOFS	77.35	81.13	74.25	86.58	78.80	1.257	0.869	4.03	0.73
MTO	71.21	75.39	74.42	93.64	88.30	8.125	0.087	4.24	0.88
TO1	82.57	87.63	81.33	78.09	69.78	2.224	0.695	3.81	1.06
TO2	80.11	86.29	50.79	90.61	72.84	8.099	0.088	4.25	0.59
MTS	81.48	80.55	53.08	83.47	83.36	5.462	0.243	4.10	0.90
TS1	79.79	82.87	67.88	91.89	66.10	7.215	0.125	4.25	0.78
TS2	76.05	81.68	67.54	94.09	73.56	6.943	0.139	4.42	0.78
TS3	73.57	79.92	55.58	92.78	89.08	9.325	0.053	4.35	0.63
MTM	71.26	81.66	74.63	93.30	83.82	7.237	0.124	4.38	0.72
TM1	77.18	75.47	53.13	86.57	93.70	9.176	0.057	4.33	0.71
TM2	79.21	91.74	62.42	88.72	68.32	6.144	0.189	4.03	0.76
MTF	82.02	78.76	71.29	86.91	69.36	3.085	0.544	3.91	0.95
TF1	79.23	97.66	62.54	85.28	68.94	7.353	0.118	3.96	0.90
TF2	76.10	85.29	62.00	94.33	72.98	7.973	0.093	4.21	0.86
TF3	83.50	79.32	57.00	79.32	83.50	27.933	0.000	0.96	0.21
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.						0.782			
Bartlett's Test of Sphericity						Approx. Chi-Square		477.264	
						df		45	
						Sig.		0.000	

Table 11 presents the results obtained for questions of the influence of the Organizational factors associated with BDA. The results of the Kruskal Wallis Test indicate that there are no significant differences between the five groups with a significant level greater than 0.05. the average is greater than 4 The Std. Deviation for all expressions is less than one so that the trends of the research sample items tend to agree on the importance of most of the items, except the questions of what is the influence of the organizational factors influencing the use of ADA (Asymp. Sig.<5%) that mean there is a difference in the perception of academics, external auditors, financial accountants, and financial analysts and

others. Factor analysis model showed that the Bartlett test for the data was 0.000 which is less than 0.05. Thus, the result revealed that the factor analysis is significant at less than 1%. In general, the Kaiser–Mayer Olkin of 0.782 (that is 78%) and Bartlett test of 0.00 showed that the components are appropriate and significant at less than a 1% level of significance. The results showed that the most important variables are the staff are interested in ADA and enjoy using it and they perceive that the use of ADA enables them to add value to the client and promote job satisfaction, the least The importance of having a decentralized organizational structure for the audit facility that helps to use (BDA).

Table 12: Environmental Factors

	Academics	External Auditor	Financial Accountant	Financial Analyst	Others	Kruskal-Wallis H	Asymp Sig.	Mean	Std. Dev.
ME	87.16	84.05	49.92	80.66	71.74	7.742	0.101	4.28	0.53
MEC	85.21	72.05	49.63	84.76	79.84	8.775	0.067	4.40	0.65
EC1	79.45	80.24	60.13	85.22	82.86	3.357	0.500	4.28	0.80
EC2	85.55	79.37	62.58	79.46	75.22	3.576	0.466	4.35	0.75
EC3	90.73	96.82	54.79	70.99	65.12	16.449	0.002	4.13	0.75
EC4	79.92	79.26	58.13	93.42	70.86	8.203	0.084	4.20	0.76
EC5	88.87	78.29	61.00	70.22	82.22	7.347	0.119	4.19	0.76
EC6	80.25	86.71	61.54	88.49	70.20	5.918	0.205	4.40	0.69
EC7	75.49	66.29	86.33	89.64	84.44	5.650	0.227	4.45	0.66
competition	78.16	76.24	76.17	86.17	80.10	1.087	0.896	4.39	0.57
MER	77.67	71.63	70.71	90.80	80.46	4.042	0.400	4.27	0.79
ER1	77.99	87.05	77.71	79.36	81.94	0.848	0.932	4.50	0.61
ER2	89.55	86.32	47.08	82.38	62.56	13.770	0.008	4.17	0.66
MEI	87.90	83.66	56.83	77.66	71.36	7.015	0.135	4.12	0.80
EI1	86.39	84.92	52.00	87.07	62.34	12.619	0.013	4.23	0.75
EI2	84.50	71.95	71.25	80.32	78.14	10.474	0.033	0.94	0.23

KMO and Bartlett's Test

Kaiser–Meyer–Olkin Measure of Sampling Adequacy 0.854

Bartlett's Test of Sphericity Approx. Chi-Square 628.807

df 66

Sig. 0.000

Table 12 presents the results obtained for questions of the influence of the Environmental factors associated with BDA. The results of the Kruskal Wallis Test indicate that there are no significant differences between the five groups with a significant level greater than 0.05. the average is greater than 4 The Std. Deviation for all expressions is less than one so that the trends of the research sample items tend to agree on the importance of most of the items, except the

questions of different audit engagements because of the varying systems adopted by different client firms, the nature of the audit, which may affect the use of ADA, and the influence of the environmental factors influencing the use of ADA (Asymp. Sig.<5%) that mean there Is a difference in the perception of academics, external auditors, financial accountants and financial analysts and others. Factor analysis model showed that the Bartlett test for the data was 0.000 which is less than 0.05. Thus, the result revealed that the factor analysis is significant at less than 1%. In general, the Kaiser–Mayer Olkin of 0.854 (that is 85%) and Bartlett test of 0.00 showed that the components are appropriate and significant at less than a 1% level of significance. The results showed that the most important variables are the case firms mentioned that client concerns around data security, despite being given assurance around rigor of their security protocols, the case firms commonly believe that the client’s IT infrastructure and competency in turn influence the ability to obtain relevant and reliable client data and the audit tests performed then the least which may be driven by the need to find a balance between the higher level of scrutiny shown by regulators and the pressure from clients to maintain audit fees.

Table 13: BDA Tools Used in the Auditing Process

	Engagement	Planning/Risk Assessment	Substantive Testing & Compliance Testing	Opinion Formulation and Reporting
Ratio Analysis	√			
Visualization	√	√	√	
Regression	√	√		
Descriptive Statistics.	√	√		
Clustering		√	√	
Trend Analysis		√		
Process Mining	√		√	
Expert Systems		√		√
Decision Trees				
Probability Models				
Belief Networks			√	√

Structural Models			√	
Time Series Regres- sion				√
Probability Models,			√	√
Monte Carlo Simula- tion Studies				√

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

0.784

**Bartlett's Test of Sphe-
ricity**

Approx. Chi-Square

290.128

df

10

Sig.

0.000

Table 13 presents the results obtained for questions of BDA tools used in the auditing process, the average is greater than 4, the Std. Deviation for all expressions is less than one so that the trends of the research sample items tend to agree on the importance of most of the items. Analytics using Kruskal-Wallis Test the average rank for the most tools suggest no statistically significant difference in the responses obtained from the participants in the groups (Asymp. Sig.>5%), that mean there is a difference in the perception of academics, external auditors, financial accountants and financial analysts and others. Using the Factor Analysis model that showed that the Bartlett test for the data was 0.000 which is less than 0.05. Thus, the result revealed that the factor analysis is significant at less than 1%. In general, the Kaiser-Mayer Olkin of 0.784 (that is 78%) and Bartlett test of 0.00 showed that the components are appropriate and significant at less than 1% level of significance.

Table 14: Quality of the Audit Process

	Academics	External Auditor	Financial Accountant	Financial Analyst	Others	Krusk al-Wallis H	Asymp Sig.	Mean	Std. Dev.
M_PROC	74.95	86.71	62.38	92.58	77.36	5.973	0.201	4.3941	0.51878
AP1	73.81	85.42	67.17	91.28	81.00	5.986	0.200	4.4717	0.62451
AP2	77.31	80.47	76.67	82.50	84.44	0.785	0.941	4.3962	0.72057
AP3	78.94	80.32	69.50	90.03	72.32	3.918	0.417	4.3962	0.73793
AP4	75.38	86.68	77.92	85.00	80.34	1.909	0.753	4.3962	0.64650
AP5	75.25	92.82	53.50	90.43	79.46	9.774	0.044	4.3082	0.75431
AP6	75.98	79.26	65.42	93.29	77.82	6.094	0.192	4.3962	0.67523
M_ECON	79.25	86.53	54.33	91.93	71.18	7.841	0.098	4.2484	0.59964
EA1	74.50	80.53	64.54	95.14	78.30	7.936	0.094	4.3459	0.70250
EA2	76.84	84.24	55.75	89.36	82.42	6.604	0.158	4.2767	0.72838
EA3	83.54	82.97	64.63	87.14	65.06	6.248	0.181	4.1698	0.83596
EA4	81.03	86.26	65.54	86.54	69.56	4.386	0.356	4.2013	0.76951
M_PROF	86.45	85.74	58.25	82.57	65.42	6.992	0.136	4.3323	0.60166
PA1	86.01	80.55	63.54	79.57	72.52	4.256	0.372	4.4528	0.72652
PA2	86.82	82.24	54.92	74.09	81.58	6.900	0.141	4.3459	0.77122
PA3	84.52	75.84	61.75	86.13	70.84	5.195	0.268	4.3082	0.80308
PA4	83.72	97.24	67.50	76.17	69.04	6.784	0.148	4.3082	0.78716
PA5	81.88	87.76	65.71	80.33	75.58	2.414	0.660	4.2390	0.75857
PA6	81.79	81.68	71.58	88.83	64.68	5.702	0.223	4.3396	0.73631
DEP_AUDIT	83.50	75.13	70.25	79.32	80.32	8.994	0.061	0.9560	0.20580

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.920
Bartlett's Test of Sphericity	Approx. Chi-Square
	1386.008
	df
	120
	Sig.
	0.000

Table 14 presents the results obtained for questions of The use of audit facilities (BDA) affects audit procedures, audit economics, and professional competence affect the quality of the audit process The results of the Kruskal Wallis Test indicate that there are no significant differences between the five groups with a significant level greater than 0.05. the average is greater than 4 The Std. Deviation for all expressions is less than one, Therefore, the five groups agree, and the trends of the research sample items tend to agree on the importance of most of the items. Factor analysis model showed that the Bartlett test for the data was 0.000 which is less than 0.05. Thus, the result revealed that the factor analysis is significant at less than 1%. In general, the Kaiser-Mayer Olkin of 0.920 (that is 92%) and Bartlett test of 0.00 showed that the components are appropriate and significant at less than a 1% level of significance. The results showed that the most important variables are BDA is a powerful tool with the high-quality pre-

dictive ability to define and adjust auditors' expectations at the beginning of the "planning stage", and thus the ability to control the length of the review period and then influence the cost of the auditing and The use of structured and unstructured data in the process of reviewing the financial statements and the material impact on the vision and role of the audit and understanding the facility under review and its environment and changing the expected role of then the least Influencing and disclosing audit results, increasing the need for real-time and (paperless) electronic confirmation reports.

5. Conclusion, Limitations and Suggestions for Further research

5-1 Conclusion

This research is based on a questionnaire administered to the five classes academics, external auditors, financial accountants, financial analysts, and independent practitioners are listed as 'other') six key aspects, The importance of BD, technological factors, organizational factors environmental factors, BDA tools used in the auditing process, and application determinants of BDA which increased the quality. By using descriptive statistics and factor analysis model, the Kruskal-Wallis test measures an average range of participants' responses to analyze the group difference. Based on the results of Integrity Reliability have Cronbach's Alpha value greater than 0.6 So it can be stated all the variables in the research is reliable. This means that all statement items are declared valid. results obtained for questions of the importance of BD showed that the most important variables are assisting them in risk assessment through the identification of anomalies and trends, comparison with industry data, and Sound judgment on clients going concern issue.

The results obtained by factor analysis showed that the most important technological factors are overcoming human cognitive limitations with the comparison with industry data and greater efficiency and effectiveness of work processes from using ADA. As for the organizational factors, the staff are interested in ADA and enjoy using it and they perceive that the use of ADA enables them to

add value to the client and promote job satisfaction. While Environmental factors were the case firms mentioned that client concerns around data security, BDA tools used in the auditing process. the results obtained for questions of the use of application determinants of BDA affect audit procedures, audit economics, and professional competence affect the quality.

The results showed Factor analysis that the most important variables are BDA is a powerful tool with the high-quality predictive ability to define, adjust auditors 'expectations at the beginning of the" planning stage ", and thus the ability to control the length of the review period and then influence the cost of the auditing, The use of structured and unstructured data in the process of reviewing the financial statements, the material impact on the vision with the role of the audit, understanding the facility under review and its environment and changing the expected role of then the least Influencing and disclosing audit results and increasing the need for real-time and (paperless) electronic confirmation reports.

The results reveal the importance of BDA in audit engagement, auditors' perceptions of BDA application. The determinates of BDA application and their implications on audit quality. The evidence was gathered from (1) Semi-structured interviews with heads of professional practice of audit firms in Egypt (2) responses to a detailed questionnaire from 159 engagement partners and/or auditors on their attitudes and perceptions toward the acceptance and application of BDA and BDA techniques on the auditing process. This has helped this study to identify a gap in extant literature regarding the implementation of BDA in practice and to contribute to providing insights that can be not only future researches, but also for other relevant parties such as decision-making activities, regulators, and audit practitioners. The findings reveal that the current use of BDA is generally similar throughout the audit firms in Egypt. However, there is a difference in the structure of the audit firms and the type of BDA techniques. Furthermore, the results present the determinants of using BDA with perceived relative advantage and clients being the most important factors and determine that whilst the use of BDA has allowed audit processes to become more effective. Efficiency gains have been realized, so that audit quality will prove.

5-2 Research limitations

One of the limitations of this research is the method of recruiting interviewers may cause interview participants to only consist of individuals with a positive outlook on BDA. Some of the interview participants mentioned that there may be influential people in their firm who would prefer relatively traditional audit methods due to ADA's greater chances of being held liable because of its recently established position. The main second limitation is that it doesn't take into consideration for all specialty and skill areas in BDA that a typical big data scientist might account for them. In addition to that, the sample size is small compared to the number of auditors in Egypt. The last limitation is that the generalization ability of the research findings of the study because of using a questionnaire that may not be subjective.

5-3 Suggestions for Further Research

First and foremost, the questionnaire isn't introduced to higher-level staff in the audit profession, thus, the evidence collected regarding professional judgment is not enough. in the future, research that includes top officials in the audit field should be included to make a better understanding of how BDA affect audit quality.

Secondly, the empirical evidence is based on the opinion of the audit practitioners only. It should include also audit clients, regulators, and other users of financial statements that may have different opinions.

Third, IT related skills are becoming more important in the audit field, warranting a call to redesign the academic curriculum, more researches are needed to look at how best academic institutions and professional regulatory bodies can make adjustments to most of the current curriculum that fits with the skills and abilities that are required in the audit field in these days.

Forth, quantitative or longitudinal research can be conducted to analyze the impact of BDA tools on audit quality sides. this will provide more insights into the cost and time spent and the cost of audits from the perspective of clients and practitioners.

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Appendix I

Research Questionnaire

Dear Respondent,

The two researchers are conducting a field study entitled (A proposed Framework of Big Data Analytics application drivers in external auditing and the impact in audit quality: Technology – Organization – Environment (TOE) Approach). This research aims mainly to study the effects of applying big data analyzes in the different stages of the external review process, starting from the contracting and engagement phase to the report in an effort to improve the efficiency of And the effectiveness of the review, and to link the theoretical aspect of this study with aspects of practice, a survey list has been prepared that includes a set of paragraphs that reflect the variables to be measured through a survey of your opinions, and the two researchers confirm (confirm) that your opinion poll adds a great scientific value to the research and if you wish to know The results of the research will reach you for the benefit and the two researchers appreciate your cooperation in helping them achieve the objectives of the research.

Keyword

Big Data (BD)

The definition of big data is a group of structured and unstructured financial and non-financial data obtained from internal and external sources of the facility, which is difficult to process using only one of the data management tools or using traditional data processing applications, but advanced analyzes and applications must be used to transform that huge amount of Unstructured data into information that is useful to stakeholders and relevant to the decision-making process. Big data has a set of 7V characteristics: Volume, Velocity, Variety, Veracity, Variability, Value, and Visualization.

Big Data Analytics (BDA)

Big data analytics refers to the process of collecting, organizing and analyzing large data sets to discover different patterns and other useful information. Big data analyzes are a group of technologies and methods that require many forms of

integration to disclose regular values. These technologies and methods are more complex and different in the field and focus mainly on solving New problems or old problems in a better way and in more effective ways.

Auditing Quality

The International Auditing and Assurance Standards Board (IAASB) defined the concept of audit quality through three main aspects: inputs (audit standards – characteristics of the auditor), outputs (auditor's report and communications) and the context in which the review process takes place (governance – law – reputation).

Inspection list

Name (optional):

Occupation:

- Faculty member
- External reviewer
- Financial Accountant
- Financial Analyst
- Other

Qualification

- BA
- master
- PhD
- Other university and professional degrees

Experience

- Less than 5 years old
- 5–10 years
- 11–20 years old
- More than twenty years

	statements	Strongly Disagree	Disagree	Neutral	agree	Strongly agree
MB	What are the benefits / challenges associated with Big Data Analytics?					
B1	Providing audit evidence through a comprehensive analysis of organizations' general ledger systems	1	2	3	4	5
B2	Assisting them in risk Assessment through identification of anomalies and trends, and comparison with industry data	1	2	3	4	5
B3	Testing complete sets of data instead of taking sample testing	1	2	3	4	5
B4	Planning proper field works for auditors	1	2	3	4	5
B5	Fraud detection and Improving other forensic accounting	1	2	3	4	5
B6	Using predictive models to improve forecasting	1	2	3	4	5
B7	help to integrate non-traditional sources of data with financial data	1	2	3	4	5
B8	Sound judgment on clients' going concern issue	1	2	3	4	5
		Not important	Little important	medium importance	importance	very important
MT	What is the influence of the Technological factors?					
MT1	Perceived relative advantage					
TA1	greater efficiency and effectiveness of work processes from using ADA.	1	2	3	4	5

TA2	Greater efficiency can be as a result of lower labour hours, automation of processes and use of relatively advanced tools.	1	2	3	4	5
TA3	Greater effectiveness is mainly an expected advantage obtained from the ability to look at whole populations of data and identify risk areas and greater assurance about the adequacy of work carried out.	1	2	3	4	5
TA4	Better understanding of the client further leads to improved communications with the client and the ability to provide additional insights, many exceptions /anomalies are identified	1	2	3	4	5
MT2	Perceived ease of use					
TE1	the new tools appear easy to use.	1	2	3	4	5
TE2	the new tools having automated what would have previously	1	2	3	4	5
TE3	been several steps in a process.	1	2	3	4	5
TE4	overcoming human cognitive limitations,	1	2	3	4	5
TE5	the abundance of selection being made available	1	2	3	4	5
TE6	lead to information overload or make systems more complex to use.	1	2	3	4	5
MTC	the technological capacity	1	2	3	4	5

TC1	The efficiency of big data analysis tools increases the technological capacity	1	2	3	4	5
TC2	The efficiency of staff at the audit facility motivates the use of BDA))	1	2	3	4	5
DEP_ TECH	Do technological factors influence the use of big data analysis?	1	2	3	4	5
MOFS	What is the influence of the Organizational factors?					
MTO	Organizational structure					
TO1	The importance of having a decentralized organizational structure for the audit facility that helps to use (BDA)	1	2	3	4	5
TO2	The importance of having a central organizational structure for the audit facility that helps to use (BDA)	1	2	3	4	5
MTS	organizational strategy					
TS1	The importance of having a central organizational structure for the audit facility that helps to use (BDA)	1	2	3	4	5
TS2	The importance of having a decentralized organizational structure for the audit facility that helps to use (BDA)	1	2	3	4	5
TS3	Management must be supported and motivated to use big data analytics	1	2	3	4	5

MTM	the Management attitude					
TM1	Most of the firm cases found management advocacy of the use of ADA to be a driving factor	1	2	3	4	5
TM2	Most of the support displayed trickles down from upper management to lower management, and eventually to staff in a top-down fashion.	1	2	3	4	5
MTF	the Staff acceptance					
TF1	accepting of ADA, but even preferring to use it over relatively traditional audit methods	1	2	3	4	5
TF2	the staff are interested in ADA and enjoy using	1	2	3	4	5
TF3	they perceive that the use of ADA enables them to add value to the client and promote job satisfaction	1	2	3	4	5
DEP_ORG	Do Organizational factors influence the use of big data analysis?	1	2	3	4	5
ME	the influence of the Environmental factors					
MEC	pressure from clients					
EC1	The size of the client entity was also found to influence the client's IT infrastructure and competence.	1	2	3	4	5
EC2	a larger client would generally require a longer audit engagement with a higher fee, which would allow firms to invest more time and resources to enable the use of ADA.	1	2	3	4	5

EC3	The case firms commonly believe that the client's IT infrastructure and competency in turn influence the ability to obtain relevant and reliable client data and the audit tests performed	1	2	3	4	5
EC4	different audit engagements because of the varying systems adopted by different client firms	1	2	3	4	5
EC5	IT infrastructure and audit client efficiencies may be a precondition not only for the use of (BDA) but also in relation to other (BDA) effects. Regarding its other effects	1	2	3	4	5
EC6	The case firms mentioned that client concerns around data security, despite being given assurance around rigor of their security protocols,	1	2	3	4	5
EC7	The importance of activating the rules and mechanisms of governance for the audit client facility	1	2	3	4	5
com	the competition that all the large audit firms are using ADA, and the need to keep up with, or be ahead of the competition in terms of leveraging new technological advancements	1	2	3	4	5
MER	the regulators					
ER1	regulators see the use of ADA as potentially improving audit quality and will eventually anticipate the use of ADA.	1	2	3	4	5

ER2	the lack of guidance and perceived limited ability to place reliance on the auditing standards	1	2	3	4	5
MEI	the audit industry					
EI1	The auditing profession tries to find a balance between the requirements of the professional bodies and the pressure from clients to maintain audit fees.	1	2	3	4	5
EI2	The nature of the auditing process may affect the audit firms' use of big data analyses	1	2	3	4	5
DEP_ ENV	Do Environmental factors influence the use of big data analysis?	1	2	3	4	5
Eng.	Engagement					
E1	ratio analysis of audited statements	1	2	3	4	5
E2	text mining	1	2	3	4	5
E3	visualization	1	2	3	4	5
E4	regression	1	2	3	4	5
E5	descriptive statistics.					
p.risk	Planning/Risk Assessment	1	2	3	4	5

P1	Clustering	1	2	3	4	5
P2	Visualization	1	2	3	4	5
P3	Regression	1	2	3	4	5
P4	belief networks	1	2	3	4	5
P5	expert systems	1	2	3	4	5
P65	descriptive statistics	1	2	3	4	5
P7	trend analysis	1	2	3	4	5
sub.com	Substantive Testing & Co- pliance Testing					
S1	Clustering	1	2	3	4	5
S2	process mining	1	2	3	4	5
S3	visualization	1	2	3	4	5
S4	expert systems	1	2	3	4	5
S5	decision trees	1	2	3	4	5
S6	probability models	1	2	3	4	5

S7	belief networks	1	2	3	4	5
S8	regression	1	2	3	4	5
S9	structural models	1	2	3	4	5
OFR	Opinion Formulation and Reporting					
O1	time series regression	1	2	3	4	5
O2	probability models,	1	2	3	4	5
O3	belief networks	1	2	3	4	5
O4	expert systems	1	2	3	4	5
O5	Monte Carlo simulation studies	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	agree	Strongly agree
M_PROC	influence of the auditing process					
AP1	Improving the processing of audited information compared to traditional techniques and the need for more structured, routine and technology-oriented audit procedures and an increase in the actual and expected capacity of auditors in Professional judgment	1	2	3	4	5

AP2	Making the best use of big data in dealing with information processing weaknesses such as assessing the risks associated with accepting or continuing the audit process and identifying the risks of material misstatements in the financial statements	1	2	3	4	5
AP3	Assist in using analytical procedures and increasing predictive power to use information in forecasting, such as assessing the facility's ability to going concern	1	2	3	4	5
AP4	Increase the level of adequacy and relevance of the evidence that is used in the audit to demonstrate the accuracy of the financial statements and the reports that are disclosed	1	2	3	4	5
AP5	Influencing and disclosing audit results, and increasing the need for real-time and (paperless) electronic confirmation reports	1	2	3	4	5
AP6	Influencing the mechanisms of the audit process and presenting a comprehensive picture of the overall performance of the facility under review	1	2	3	4	5
M_ECON	Economics of auditing					
EA1	Influencing the audit facility's strategy to expand business, maintain competitive advantage, and increase necessary investment in technology while continuing training and development	1	2	3	4	5

EA2	Big data is a powerful tool with high-quality predictive ability to define and adjust auditors' expectations at the beginning of the " planning stage ", and thus the ability to control the length of the review period and then influence the cost of the auditing	1	2	3	4	5
EA3	The audit facilities seek to expand the provision of other advisory services to increase the necessary investment support required in the process of developing and maintaining BDA algorithms, software and other tools	1	2	3	4	5
EA4	The use of structured and unstructured data in the process of reviewing the financial statements and the material impact on the vision and role of the audit and understanding the facility under review and its environment and changing the expected role of	1	2	3	4	5
M_PROF	Professionalism					
PA1	Big data analysis affects the nature of the skills required for the auditor and the need for more technical competencies and this is reflected in the importance of training and professional qualification of the audit team	1	2	3	4	5
PA2	Data processing and analysis requires more experience and knowledge of BDA environments, which affects	1	2	3	4	5

	the process of intellectual and intellectual inference of auditors when expressing an opinion on the financial statements					
PA3	The use of big data analysis reduces audit constraints, allowing the auditor to provide a higher level of assurance that is sufficiently satisfied	1	2	3	4	5
PA4	(BDA) is linked to the necessity of providing an appropriate environment for the development of auditors' professional competence with the importance of strengthening professional and organizational bodies through criteria and guidelines to increase the	1	2	3	4	5
PA5	That BDA technologies can change the organizational structure of audit facilities, while highlighting the importance of industrial or sectorial specialization to auditors	1	2	3	4	5
PA6	The importance of developing technologies to integrate big data with traditional audit evidence to retrieve relevant audit evidence from the use of (BDA) more efficiently, which gives a better complementary view of customer data and a better direction of	1	2	3	4	5
DEP_ AUDIT	The use of audit facilities (BDA) affects audit procedures, audit economics and professional competence affect the quality of the audit process?	1	2	3	4	5