



# Big Data and Big Data Analysis in Audit Firms

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## Abstract

### Research purpose:

*The primary objective of this exploratory research is to comprehensively examine the factors associated with the implementation of big data and the utilization of big data analysis techniques within audit firms situated in Vietnam. This study aims to shed light on the current practices pertaining to big data and its analysis, while also highlighting the challenges encountered by these audit firms in the process.*

### Research motivation:

*Big data and big data analysis have been adopted in variety of sectors; however, it is an emerging issue in the auditing profession. According to previous research, the application of big data and big data analysis in audit practice is not as frequent as in other sectors. In addition, research on this issue in auditing is considered to be limited, especially in Vietnam. Therefore, the current study aims to find out the current practice of big data and big data analysis in reality among audit firms in a developing country, Vietnam.*

### Research design, approach, and method:

*Through the utilization of qualitative research methods, including interviews and a thorough analysis of secondary data, this study seeks to uncover valuable insights into the dynamics of big data implementation within the Vietnamese audit industry.*

### Main findings:

*The study's findings provide an understanding of the factors influencing the adoption of big data and its analysis techniques within the audit sector. Notably, the research finds factors including the size of audit clients, global strategies adopted by prominent audit firms, and the competitive landscape of the Vietnamese audit market as pivotal determinants shaping the integration of big data analysis in audit firms. Moreover, the study highlights the challenges that audit firms in Vietnam confront when implementing big data and big data analysis*

### Practical/managerial implications:

*The current study makes contributions to literature related to big data and big data analysis in the auditing profession. The research issues are emerging and there is limited number of studies conducted in developing countries. It is the first comprehensive study in Vietnam that utilizes qualitative methods to investigate the research issues. The study also makes practical contributions for auditing profession in Vietnam. The results reveal the current practice of big data and big data analysis in audit firms in Vietnam and difficulties that audit firms in Vietnam have to deal with when implementing such kind of modern technology. The results of the study may be useful for audit firms and audit regulators in their decision- making processes.*

**Keywords:** Big data, big data analysis, audit firms, current practice, audit market, challenges.

## 1. INTRODUCTION

Numerous client systems are currently becoming more and more connected with external data sources including social media, the cloud, and the Internet of Things. Client data may demonstrate big data (BD), which has a huge volume, fast speed, and variety. These data could originate from sensors, movies, and other text-based social media—all of which an auditor is frequently unfamiliar with. However, the external auditor has virtually endless opportunity to use advanced

analytics thanks to this Big Data (Appelbaum et al., 2017). Big data as a concept is often discussed in conjunction with analysis of big data (Earley, 2015). Big data analysis (BDA) is the process of inspecting, cleaning, transforming and modelling BD to discover and communicate useful information and patterns, suggest conclusions and support decision making (Dagilienė & Klovienė, 2019). BD in the accounting literature is often defined by the types of analysis that can be performed with the data, such as data analytics or predictive analytics, rather than as a type of data source. The techniques used by academics to perform empirical research are remarkably similar to BDA procedures (Earley, 2015).

BDA necessitates a sizable investment in hardware, software, and talent development in order to enable acceptable data extraction from clients and other third parties. The Big Four audit firms recently made significant financial investments in the acquisition or development of new technologies for evaluating business performance, such as Deloitte's text mining tool for extracting important information from unstructured data. KPMG has created big data evaluation solutions in order to better serve its clients. Medium-sized and small auditing businesses have also embraced contemporary data analysis applications to enhance their data analysis capabilities. The use of BDA by auditors may enhance the efficiency and trustworthiness of audit reports, according to prior study. Additionally, a number of studies show that auditors can analyze a whole transaction, and using BDA to evaluate corporate performance, to enhance risk assessments, objective methods, and the internal control test (Alrashidi et al. 2022).

However, auditing lags behind the other BD research streams and the application of BDA (Dagilienė & Klovienė 2019). Research on BD and BDA in auditing profession is emerging and attracting attention from scholars around the world. The number of academic research on this topic in Vietnam is limited. This research aims to find out audit firms' motivations to implement BD and BDA in their services; those audit firms' current practice of BD and BDA and challenges faced by such firms when adopting BD and BDA in Vietnam.

In the next section, we provide a review of prior research on Big data and Big data analysis in auditing. The explanation of the research technique and data set used in the study follows. Findings and an analysis of the findings are then presented. The ramifications of this research, including its limitations, are discussed in the study's final section.

## 2. LITERATURE REVIEW

### 2.1 Big data and big data analytics

There is no denying that the globe generates enormous volumes of data. However, 'big data' is more than just volume. The "3 Vs" - vast data volumes, high-velocity data flows, and a broad variety of data, especially unstructured and semi-structured data like text and images - are frequently used to describe big data. Three factors: increasing computing power, new data sources, and infrastructure, mentioned as the trend of big data. It has played a significant role in machine learning advancements in recent years, supporting the expansion of artificial intelligence in a number of business sectors (ICAEW 2019).

According to Earley (2015), Compared to other disciplines, such as consulting or forensic investigative techniques, the audit has adopted BDA at a slower rate. Audit firms would exercise greater caution when investing in BDA in the audit profession due to the liability issues and the highly regulated environment of auditing. BDA, however, is being thought of as the auditing industry's future. Since the use of paperless audit techniques, it has the potential to change how audits are conducted. For audit firms and auditors, BDA in audit practice presents both opportunities and obstacles.

Using BDA on audits offers the following four main advantages: Auditors can check more accounting transactions; Audit quality can be improved by providing deeper insights into clients' processes; Fraud will be easier to find because auditors can use the better tools and technology; and auditors can offer services and handle issues for their clients that are beyond current capabilities by using external data to inform audits. In order to verify whether account balances are correctly stated, auditors have recently used a risk-based approach and sample transactions. With the use of BDA, auditors will be able to automatically test all transactions.

The use of big data analytics for auditing is not immediately apparent because accounting data, even with billions of transactions, is still considered "small" in the perspective of "big data." Accounting data also typically includes debit and credit accounts and is well-structured. Even though accounting data are not regarded as "big," big data analytics techniques can nevertheless be used on lesser amounts of transactions. Therefore, these processing models can be employed to make full audits rather than partial, random audits. (Tiberius & Hirth, 2019).

### 2.2 Previous studies on BD and BDA

The adoption of BDA technologies is regarded as a crucial component of audit firm's programs for changing audit practice and methodologies, particularly within large audit firms. All of the Big Four audit firms had BDA toolkits for advanced data collecting from diverse sources and data processing to improve the efficiency of audit procedures by the year 2015. Some audit firms, including KPMG decided to create these tools in collaboration with an outside supplier, McLaren Applied Technologies (Salijeni et al. 2021).

Dagilienė & Klovienė (2019) determines how a business plans to use big data and big data analytics in external audits. The research revealed that the average amount of BDA usage experience among in audit was three years. The main goals of using modern analytics in large network audit firms were to ensure the quality of the audit process and to produce an

appropriate auditor's report. These goals were often based on the global strategy of IT innovations. The outcomes also show that contingent factors may have an impact at both the corporate and institutional levels. The use of BDA in various audit phases was directly impacted by company-related factors, particularly due to the audit firm's data-driven strategy and the audit client's size. The utilization of BDA for audit companies was determined to be influenced by a company element like size. The use of BD and BDA in external auditing was primarily driven by large audit clients since these audit clients' present business processes permit and facilitate the use of Big Data in audit firms. Large audit clients frequently take the lead in implementing BD and BDA, whereas audit firms typically follow. Using BDA would be difficult for a small audit firms due to a lack of expert people and technological capacity. The findings also suggest that a company's strategic orientation and organizational design may potentially have a significant impact on the use of BDA. The scale of the business and the strategic direction or attitude toward the adoption of technology both have an impact on competent workers and internal capabilities, which are resource-related audit firm factors. Furthermore, as audit firms must assess environmental uncertainty and adjust to it, the audit market environment (the national regulator's policies or the level of competition) could be considered an indirect contingency factor. An audit firm's decision about the design of an audit strategy, such as how to embrace current auditing techniques, how to ensure audit quality, and what themes for auditors' training should be, may be particularly influenced by audit market regulations and education.

Salijeni et al. (2019) studies the effects of BDA on the nature of the connection between auditors and their clients; the implications of the technology for the performance of audit engagements; and the typical difficulties associated with integrating BDA into the audit context. It is proposed that the importance of these problems as customers' increasing reliance on BDA tools generate chances for auditors to evaluate and make sense of the vast data sets pertaining to the clients' business systems. The businesses use BDA as a foundation for extending the scope of services provided to clients, particularly those that are more advisory in nature, within the constraints imposed by regulations on the joint offering of audit and non-audit services.

More and more often, their audit teams do not need to be physically present at the client premises because BDA solutions are used to acquire pertinent information from their clients' ERPs regardless of where the audit team locate. Auditors have more time to focus on complicated problems and matters that call for professional judgment. It is discovered that BDA may be helpful to auditors in a variety of situations, such as those involving audit planning and risk assessment, evidence gathering, and the execution of substantive and analytical procedures. The results do, however, also point to a number of difficulties with the use of BDA tools in the audit environment, such as the testing of entire populations made by these techniques that are seen as "false positives." This means that BDA may produce evidence that suggests a problem that needs the auditor's attention, even while the opposite is true. Conflicts between auditors and data scientists over their respective roles in integrating BDA into regular audit procedures and processes have are other issues.

Richins et al. (2017) contend that big data analytics enhances the abilities and knowledge of accountants rather than taking their place. To address the difficulties presented by big data analytics, the education department, standard-setters, and professional bodies must modify their curricula, standards, and frameworks. The results point to BDA features such scripts as having enabled extensive automation of audit procedures, opening up possibilities for increasing the evidential scope and depth of audit work. Additionally, the research demonstrates how the visualization dashboards have improved auditors' capacity to explain and defend their conclusions. Finally, they show how BDA has altered the nature of work relationship and flows across the various roles and service lines offered by audit firms.

Kend & Nguyen (2020) concludes that the impact of BDA, robotics, and AI on auditing is viewed as good overall. BDA frees up auditors from manual, time-consuming duties and offers them more time to focus on critical evaluation-type work or important audit judgments. The need for regulators and standard-setters to keep up with the rapid IT and automation evolution in the auditing industry was also stressed by research participants. The participants in the research also appeared unconvinced about the use of block chain technology in auditing practice.

According to Alrashidi et al. (2022), BDA affects audit procedures at all stages of the auditing process, where it contributes to the information delivery that aids auditors in understanding the client's internal and external environments and influences the decision to accept the audit engagement. Additionally, BDA makes it simple for auditors to do analytical operations, calculate client risks, and comprehend and assess the internal control system by supplying crucial information. Because it contributes to the creation of added value for both auditors and their clients, auditors must expand their skills in the BDA field.

Serag & Al-Aqiliy (2020) shows a few important findings related to the application of BDA in external auditing. The study reveals a tendency among external auditors to focus on applying BDA techniques in audit engagements not only to satisfy regulatory requirements but also to add value for business clients and the auditing quality triangle's three axes (efficiency, effectiveness/cost reduction, and quality). Additionally, obstacles like the size of audit firms, the infrastructure of information systems, and long-term audit engagements limit the use of BDA approaches in audit in Egypt.

However, Gepp et al. (2018) finds that big data techniques are used less frequently in auditing than in other sectors. It is due to the fact that auditors are hesitant to use methods that are far superior to those employed by their audit clients.

Although BDA has enormous promise for the auditing practice as well, its widespread application on audit engagements has lagged behind other practice areas in terms of adoption. This is because adopting BDA in auditing offers special difficulties that don't apply to other practice areas. Although it may seem as though BDA is not being adopted as quickly in auditing, public accounting firms are nonetheless investing heavily in creating audit-related BDA, and it won't be long

before we start to notice the transformational effects of these efforts (Earley, 2015).

Hezam et al. (2023) also concludes that big data analytics are noticeably lacking from the audit domain. It is also discovered that eight issues have emerged for audit quality improvement as organizations develop methods for utilizing data analytics, including i) difficulties with auditors' training and competence, ii) The potential for data destruction incidents in auditing due to cyberattacks or a lack of data filtering skills, iii) Joblessness as a result of automation iv) The need to extract and process enormous amounts of data, which necessitates large computer storage and analytical software, v) The analytical software's capacity to handle different types of data, vi) information overload, which could lead to incorrect interpretation and, ultimately, incorrect decision making, vii) The auditor's access to all data is constrained, and data-related issues, such as data ambiguity, are also present. Finally, viii) The expectation gap needs to be addressed by legislators and auditors. This information helps audit firms create plans for employing big data analytics to provide favorable audit results.

De Santis & Donza (2021) investigates the use of big data and big data analytics in financial auditing, paying particular attention to the process of establishing legitimacy around these techniques, the variables promoting such a procedure, and the steps auditors take to establish BDA's legitimacy both inside and outside the audit community. The BDA-driven audit innovation process is led by the Big Four, and BDA is utilized to complement conventional audit techniques. Outside of the audit community, the audit customers' level of digital maturity, the absence of audit standards, and the disapproval of the audit oversight body prohibit BDA from receiving full legitimacy.

According to Alrashidi et al. (2022), the emergence of big data and digitization has presented opportunities and difficulties for the audit profession. The audit profession will move toward continuous auditing as a result of technological developments, but new technology will also help auditors. With the use of digital technology and BDA, auditors will be better able to offer new services and review all customer data. BDA gives auditors a tactical edge when providing their clients with business-related insights. BDA contends that one of the biggest obstacles to its adoption in the audit profession is audit customers' inability to keep up with technology advancements and that this is why it will take time for BDA to become widely accepted in the area of auditing. Due to changes in audit evidence's effectiveness and character, conventional audit evidence is no longer sufficient. BDA permits auditors to access evidence that aids them in all future audit stages.

Overall, there have been studies conducted in countries over the world on BD and BDA, however, there is a lack of research on such issues in Vietnam. The current study aims to fill the gap in the auditing literature by investigating the motivations, current adoption of BD and BDA in audit firms in Vietnam and challenges faced by such firms.

### 3. METHODOLOGY

The present study uses qualitative method to collect and analyze data. Methods of collecting data from multiple sources: interviews, and documents from other sources were used for the present study. The goal of a qualitative interview, according to Kvale and Brinkmann (2009), is to gain insight into the subject's perspective on the world. Respondents can express their viewpoint and use their own words during interviews (Kvale, 1996). For three main purposes, in-depth interviews were used in the current study's data collection. The researcher can start by asking a set of questions that have been created to gather data for a specific goal. Second, the researcher can manage the dialogue well by using an in-depth questioning strategy. Lastly, an in-depth interview pushes participants to share as much information as they can in a free-flowing setting (Hecimovic & Martinov-Bennie, 2009). The researcher will elucidate the responses or ask for examples to acquire a thorough understanding of the subject (Wahyuni, 2012). An in-depth interview aims to learn more by providing facts and insights to clarify various viewpoints and interpretations of events (Holstein & Gubrium, 2002).

In the current research, in-depth face-to-face interviews with auditors were conducted to access their perceptions about the motivations of the adoption of BD and BDA, the current practice of BD and BDA in audit firms in Vietnam, the challenges faced by these audit firms when implementing such kind of modern technology. The researcher conducted interviews with practicing auditors to gain insights into their perception of the research issues. These auditors have experience in a variety of industries, and participate in the audit of clients from small to large. The intended questions for each interview in the current study were developed from a variety of sources, including relevant literature, the researcher's knowledge, and observation. To make sure the interviewees would understand the questions, two pilot test interviews with Vietnamese auditors were done. In order to make it simpler for candidates to understand the meaning, the interview questions were then refined. Final interview questions are as in the following table:

Question Number	Content
1	In your opinion, what is big data in audit?

	What is big data analysis in audit?
2	In your audit firms, do you use big data and big data analysis technique in audit practice?
3	If the answer to question 2 is yes, what are reasons for that?
4	If the answer to question 2 is no, what are reasons for that? Does your audit firm have plans to implement big data and big data analysis in the future?
5	Which data analysis software that your audit firm are utilizing?
6	What are factors that affect the adoption of big data analysis in your audit firm?
7	Do you face any difficulties when adopting the big data and big data analysis?
8	If the answer to question 6 is yes, what are the difficulties?
9	How do you deal with these mentioned difficulties?

37 Vietnamese auditors (auditors, audit managers, and audit partners) participated in the interviews. Male and female interviewee numbers (Male: 20 & Female: 17) did not differ significantly. The interviewees' ages range from 32 to 55. The 37 interviewees' descriptive features are listed in the following table:

Auditors	Number	Gender	Age Range	Years of experience
Team leader Auditors	16	M (8) F (8)	32-40	8-12
Audit Managers	12	M (7) F (5)	35-48	10-20
Audit Partners	9	M(5) F(4)	45-55	15 and above

Face-to-face interviews were used to collect data from March 2023 to April 2023. Each interview lasted about 50-70 minutes. With the interviewee's consent, all interviews were audio recorded in order to preserve the details of the in-depth discussions. Following that, the audio tape was transcribed into texts. As needed by the human study ethical permission we received, each interviewee's identity was tagged to maintain confidentiality.

Other sources of information utilized for the current study consist of Vietnamese published articles and websites. The researcher has collected published articles from specialized journals, International Auditing Journal, Accounting Journal, International Journal of Business and Social Research and information from the following websites: <https://mof.gov.vn/>; <https://tapchicongthuong.vn/>; <https://kpmg.com/vn/vi/home.html>.

Thematic analysis, a qualitative data analysis method, was used in the present study. The current study adopts Braun and Clarke (2006)'s steps in data analyzing. These steps are: becoming familiar with your data, creating initial codes, looking for themes, reviewing themes, defining and labeling themes, and publishing the report.

Conclusions are reached and verified using thematic analysis (Boyatzis, 1998). In the current study, before the interviews started, general codes on the topics of research were created, and these codes were improved as the interviews went on. With this method, we were able to code interviews from the very beginning and improve the analysis' traceability and

verification. Coding the qualitative data involved creating a list of themes and patterns that causally connect themes and help to describe and arrange the interviewees' findings. In developing the analysis and conclusions, it's critical to include evidence that supports patterns and to be receptive to material that challenges them; doing so helps avoid presenting unreliable evidence. In the current study, the methods of coding, memo-writing, and diagramming were applied simultaneously throughout the data collection process in accordance with Boyatzis' (1998) recommendations.

NVIVO software was utilized in this study to aid in the data analyzing process. By using Nvivo 12, the authors were able to derive conclusions from the trends and themes in the data by identifying textual patterns from the multiple interview transcriptions.

## 4. RESULTS AND DISCUSSION

### 4.1. Audit firms' motivations for adoption of BD and BDA

The results from interviews and secondary data indicate that audit client's size is the most important factors that affecting the adoption of big data and DA in audit firms. Small audit clients will naturally not have data that fits the definition of big data. With such kind of audit clients, auditors from both Big 4 and non-Big 4 audit firms consider excel as most effective way to analyze data. It is not necessary to utilize audit analytical software in these cases. Multinational companies and big groups are large drivers since they often have big data. Big data analytics can assist audit firms in auditing such kind of audit clients.

*"For example, auditing Vinhomes, selling brokerage costs, selling apartment revenues, there are several million lines, this is big data. That's why my company is thinking about using data analysis software to handle such big data. Currently using on excel, it doesn't make sense to have a few million transactions, and we check the details of a few hundred transactions. Therefore, data analysis software is needed for general analysis of all transactions".* From auditor 3 in a large audit firm, Non-big 4.

*"General journal, customer's transactions can be up to many millions of lines. My audit firm can handle the data like that. Our audit firm uses software to assist auditors in the process of performing analytical procedures, big data analysis software".* From auditor 1 in a Big 4 firm

The results of this current study is consistent with the results of Dagilienė & Kloviėnė (2019). BD comes from Audit clients first with the increasing number of big group. When their scale is larger, these audit clients must adopt BD for their operational management. Other audit clients may implement BD for their competitiveness in the market. Therefore, in order to provide audit services and other consulting services to such large audit clients, audit companies must also implement BDA. Large audit clients frequently take the lead in implementing BD and BDA, whereas audit firms typically follow.

The global audit firms' strategy factor is also considered another important driver for audit firms to adopt BDA. To be a part of a global networks plays an important role in using BD in external auditing and the client's performance. The motivation of audit firms to invest in data analytic software relies primarily on the size of the company and its strategic orientation. International audit firms are acquiring powerful data analytics tools. Big 4 audit firms in Vietnam are implementing the modern data analytic software to deal with Big data of audit clients. Large audit firms in Vietnam which are non-Big 4 but are members of other global audit firms are also planning to adopt big data analytic tools under the pressure from the parent audit firms. That is consistent with the results of Dagilienė & Kloviėnė (2019). Depending primarily on the data-driven strategy of the audit firm, company-related factors directly impacted the use of BDA in various audit phases.

*"Only the leading enterprises in their industry have big data. Small businesses do not have big data to do. Vietnamese businesses still mainly use accounting software misa, fast. Large audit clients have big data. Currently, my audit firm does not use big data, does not have data analysis software, but we also have to update it in the future. My audit firm is a member of HLP. In the future, my audit firm will also have to follow the global trend of big data and BDA".* From auditor 2, a large audit firm, non-Big 4 firm.

*"It is important to note that the size of the company determines the use of BD technologies not only due to the size of the audit firm itself, but also due to the pressure from the global audit firms network. We are also planning to utilize BD technologies".* From auditor 1, a large audit firm, non-big 4.

Another factor is to compete in the audit market. The biggest audit firms (international networks) treated the BD and BDA as a long-term competitive advantage in the audit industry. In the oligopoly audit market, enabling auditing technology will undoubtedly increase all audit firms' competitiveness. Big 4 firms view BD as a more and more crucial component of their assurance practice in order to differentiate themselves in the audit market. Big 4 audit companies increase their ability to compete by spending money on cutting-edge big data analysis techniques. The findings are in line with those of Salijeni et al. (2019). Audit firms use BDA as a tool to increase the number of services available to customers.

This is also comparable to the findings from Dagilienė & Kloviėnė (2019). The biggest audit firms (global networks) viewed the BD and BDA favorably and viewed them as long-term competitive benefits in the audit industry.

*"The reasons to perform an audit are more focused on risks, conduct it in a better, quality manner, adapt to progress. Effectiveness is at the first place as competition by prices is essential. We are working totally in electronic space. Hence, we can compete in the audit market".* From auditor 2 in a Big4 firm.

## 4.2. Current practice of big data and big data analysis in audit firms

### Non-big four audit firms which are large

The results show that at present, large audit firms which are non-Big 4, the audit process is still conducted manually and auditors have not fully applied computerized audit tools. Computer-aided audit tools and techniques are mainly excel among those audit firms. However, almost these large audit firms are members of international audit firms and they have plans to implement BD in the future to follow the trends of global networks.

*“Only the leading enterprises in their industry have big data. Small businesses do not have big data to do. Vietnamese businesses still mainly use accounting software Misa, fast. Large audit clients have big data. Currently, my audit firm does not use big data, does not have data analysis software, but we also have to update it in the future. My audit firm is a member of HLP. In the future, my audit firm will also have to follow the global trend of big data and DBA”* From auditor 2, a large audit firm, non-Big 4 firm.

### Non-big four audit firms, small and medium audit firms

All small and medium audit firms currently conduct their audit procedures manually through excel. These audit firms have not utilized audit software or other modern audit tools to supports their audit practice. According to interviewees, audit clients of these audit firms are mainly small and medium companies with the accounting data mainly exported from simple accounting software like Fast, Misa... The data of these audit clients is not big. BD and BDA are not necessary in their audit process. Conducting audit procedures through excel is still effective under the points of views of auditors from these audit firms.

*“The company does not have audit software; the audit work is done on excel. Working papers are also saved in excel. When in season, working papers are saved in excel, and when the season is over, working papers will be printed out. The company does not have big data and software to analyze data. Our audit clients are almost small”*. From auditor 6, a small audit firm, non-big 4.

Interviewees also state that their audit firms have not planned for BD or DA in the future.

*“We audit on excel, we do not use audit software. The data is taken from the customer's accounting software, then the data is exported to excel. My audit firm does not have big data nor software to analyze big data. Big data is still a strange issue for us. We do not have any plans to adopt it”* From auditor 5, a medium audit firm, non-big 4

*“Do not use audit software, all work is done in excel. No data analysis software, no big data”* From auditor 3, a small audit firm, non-big 4.

The reason for that is these audit firms' clients are small and medium. Big data are not available to these audit clients. Another explanation offered by the interviewees for why small and medium audit firms typically solely use Excel-based analytical tools is a lack of knowledge and inadequate funding for BD and DA investments.

*“We do not have enough fund to pour money into those things. We do not make a lot of profits since our audit fees are not high”*. From auditor 6, a small audit firm, non-big 4.

### Big 4 audit firms

Big 4 audit firms are increasing their technological investments because they believe that using big data in data analysis will help them succeed in the age of digital transformation. All Big Four audit firms have recently made large financial investments to either buy or develop BDA solutions. For instance, KPMG's 2014 Transparency Report noted that the company had established a \$100 million (£74.8 million) investment fund in collaboration with technological firms, with the goal of developing data analytical capabilities that could significantly transform audits and add value for clients. EY has also committed \$400 million to the development of new audit support tools like BDA. ACL and IDEA have been replaced with Halo, an internal analytical tool that PwC has developed. Halo is a "next generation software application that analyses and assures data using a suite of algorithms," according to PwC. To take use of their BDA capabilities, other, specifically smaller audit firms frequently utilize off-the-shelf analytics software like Spotlight, Lavastorm, and Alteryx (Salijeni et al., 2019).

The results from this study also confirm that Big 4 audit firms in Vietnam have already utilized the BDA, at the starting point. However, the level of use is still limited to large audit clients who have big data.

*“My audit firm uses a data analyzer software, but it has to be a customer with a very nice book to be able to import into that software. The accounting books of clients, must be suitable with the software. Then put the data in it to get the results. We get the results quickly and the software also helps us to read the results faster. But the books of Vietnamese audit clients are almost not beautiful, not suitable for that software, so its application is not high. My audit firms still mainly analyze data by using excel. Columns of this year, last year, see how data fluctuates and then focus on the risk areas”* From auditor 8, a Big 4 firm

With other audit clients, auditors from Big 4 firms in Vietnam still utilize excel as the main tool to conduct audit procedures and to analyze data.

*“In fact, I think that this data analysis software is much more useful when used for customers who use ERP and SAP, it has a lot of information that I can use. For example, the fast software that Vietnamese customers use is relatively minimal, with only basic data fields. I try to run it, it also produces results but it's not optimized, can't be used much, so this software is mainly used for customers with large data that I can't read with excel. Current customers still mainly do excel”*. From

auditor 5, a Big 4 firm.

In Big 4 audit firms Vietnam, there are specialists who are in charge of analyzing big data by utilizing the data analytic software. Whenever auditors engage in audit clients with big data, they have to consult and get support from those specialists. The interviewees state that normal auditors currently do not have enough knowledge to analyze such kind of big data.

*“We have to cooperate with persons who are in charge of analyzing big data. After the process of analyzing, they give us the analyzing results. We can read the results of analyzing”* From auditor 7, a Big 4 firm.

According to interviewees, Big 4 audit firms in Vietnam are planning to optimize BDA in the future with suitable audit clients.

*“The company's goal is that everything will put up in the data analysis software. Because it is predicted that the data of the business will grow year by year. Of course, it also depends on the type of business. For example, FDI firms, their system is complex and massive, they already have big data. Some Vietnamese businesses are moving forward. For example, a financial business, for example F88, the number of transactions is very large, so I can apply data analysis software to that. Since auditors have limited expertise in script coding, a team of data specialists and IT auditors is usually assigned to develop scripts so that tests to auditors' specifications can be performed”* From auditor 5, a Big 4 firm.

Overall, the results of the current study show that merely Big 4 audit firms in Vietnam are at the starting point of implement BD and BDA in their audit and consultant services. This is consistent with the results of De Santis & Donza (2021). The BDA-driven audit innovation process is headed by the Big Four. However, the level of adoption of BD and BDA is limited to a small number of audit clients who have big data and the data are compatible with big data analytic tools of those Big 4 audit firms. With other audit clients, auditors mainly conduct analytical procedures through excel.

With non-Big 4 audit firms, they have not started initializing such kind of modern technology. While non-Big 4 audit firms which are large and often members of international network have plans to adopt BD and BDA in the future, small and medium audit firms do not have any schedules for BD and BDA in the future. These results are consistent with Earley (2015) and Gepp et al. (2018). The use of extensive BDA on audit engagements has lagged behind other practice areas, despite the fact that BDA holds enormous promise for the auditing practice (Gepp et al., 2018).

### 4.3 Challenges faced by audit firms when adopting big data and big data analysis

The results show that there are challenges faced by auditors and audit firms in the implementation of BD and BDA.

#### ***Auditors' lack of adequate training and necessary skills to analyze Big Data***

The managers of audit firms are concerned about auditors' lack of necessary skills to properly adopt data analysis techniques and audit firms will have to start attracting and hiring data scientists with big data analysis skills. Skills needed including pattern recognition, highly data analysis techniques like regression analysis have traditionally not been the main focus of accounting education and training. Auditors may lack these necessary skills to properly apply DA techniques in audit and advisory services. The data scientists have higher big data analysis skills than traditional auditors, and auditors also get training from those scientists. Since there are far more transactions to evaluate in the BDA environment than in sample-based auditing, auditor judgment will also play a considerably larger role. Consider a scenario where an auditor wants to integrate the phone call information of each service installation with the number of orders in order to audit the revenues of an energy provider. This activity necessitates both an in-depth knowledge of the two data sets and adequate data programming skills, which highlights one of the essential elements in the big data integration process: human resources. Big data integration would need more specialized skill sets. For instance, an auditor will now need to gather and assess more pertinent evidence that is supported by big data in addition to the audit evidence relating to inventory that was previously examined. As a result, audit professionals could need to become specialists in both information technology and auditing (Nguyen 2023). The results of the current study indicate that at the moments auditors are lack of knowledge and skills related to BD and BDA.

*“In my firm, only some specialists can deal with big data analysis through the analyzing software. Big data is new with us; almost of us do not have ability to analyze such data at the moment”*. From auditor 4, a big-4 firm.

The results of the current study are consistent with the results of Hezam et al. (2023). In Hezam et al. (2023), the authors found eight challenges related to BD and BDA. Among those problems, auditors' lack of competence and skills related to BD and BDA is significant challenges that audit firms need to deal with.

The findings also suggest that training for auditors to possess BD and BDA skills has to be increased. It's challenging to find and teach future auditors who are already skilled with big data. Universities should provide data-driven accounting curricula that promote collaboration between the accounting and IT. To advance the auditor's understanding and data management abilities, audit companies and their clients should schedule regular training sessions or seminars. The auditors should be permitted to train in several departments and circulate through a variety of positions. Because new requirements for professional tests may alter the subject matter of accounting education, the role of regulatory authorities in this situation is crucial (Nguyen 2022).

*“We need deep training in the near future”*. From auditor 3, a big-4 firm.

Since then, it has become urgently necessary to expand learning and development programs and to offer skill training to students at universities and colleges. In order to assist audit teams in successfully integrating big data and analytics into the audit, the appropriate implementation and support programs need also be established (Nguyen, 2022). The findings



of this study are consistent with those of Richins et al. (2017). According to Richins et al. (2017), in order to address the difficulties posed by big data analytics, the education department, standard setters, and professional bodies must make modifications to their curricula, standards, and frameworks.

#### **Compatibility, truthfulness of data sources**

The results indicate another challenge is in some cases, the big data is incompatible. Big Data can also be unstructured in some situations, and audit clients may not be able to collect data in a fashion that is helpful to the auditor or the data may be challenging to use. Hence, it takes a lot of time to clean up the data in the format that the auditors could utilize. The results from interviewees also indicate that there are challenges in terms of data compatibility.

*“Compatibility issues with client systems may render standard tests ineffective if data is not available in the expected formats”*. From auditor 7, Big-4 firm.

*“Data may need to be drawn from multiple systems and spreadsheets which may not be compatible and may often require a lot of manual effort to clean up the data”*. From auditor 9, Big-4 firm.

Given that big data can originate from both internal and external sources, the auditor must determine whether the data is coming from a safe source and whether it can be altered before it is gathered.

*“Big data also has drawback since it comes from different sources. So, we need to verify all the data incredibility before use”*. From auditor 4, Big-4 firm.

#### **Shortage of fund**

Small and medium audit firms face difficulties in technology investment due to shortage of fund. Increasing complexity of BD leads to increased cost for companies related to hiring data scientists and investing in software. Data from secondary sources indicate that although the benefits that BD brings to businesses are great, the investment costs for it are not small and not many people know how to take advantage of it. Small and medium audit firms could not afford to invest in BD and BDA.

*“We do not have enough fund to invest in Big data analytics since our audit fees are quite low in compare with large audit firms”* From auditor 8, a small audit firm, non-big 4.

*“The cost to invest in BDA is too high in comparison with benefits. Actually we do not have money to pour in such kind of things and we also not need at the moment. Our audit clients are small, so excel is enough for us to conduct audit processes”* From auditor 6, a small audit firm, non-big 4.

The results are consistent with Serag & Al-Aqiliy (2020); Dagilienė & Klovienė (2019). The author points out small audit firm is the challenge that restrict the adoption of BD and BDA. Small audit firms do not have sufficient funds to afford BDA technology.

## **5. CONCLUSION**

Through interview and secondary data, the researchers' purposes are identifying the motivations for the adoption of BD and BDA among audit firms in Vietnam, both Big 4 and Non-big 4; the current situation of BD and BDA practice in these audit firms and the challenges that those audit firms face in the adoption of BD and BDA. Thematic analysis, a qualitative data analysis method, was used in the present study. The current study adopts Braun and Clarke (2006)'s steps in data analyzing. These steps are: becoming familiar with your data, creating initial codes, looking for themes, reviewing themes, defining and labeling themes, and publishing the report.

The findings show that the size of audit clients is thought to be the most pervasive factor influencing the adoption of BD and BDA. Large audit clients frequently take the lead in implementing BD and BDA, whereas audit firms typically follow. Another key aspect for audit firms to implement Big Data Analytics is the factor of the global audit firms' strategy. Finally, another element is the level of competition on the Vietnamese audit market. The biggest audit firms (international networks) treated the BD and BDA as a long-term competitive advantage in the audit industry.

In terms of the current practice of BD and BDA, auditing is lagging behind other professionals in the adoption of BD and BDA. Currently, merely Big 4 audit firms in Vietnam have started utilizing BDA with some kinds of audit clients, while non- Big firms have not. Audit firms in Vietnam face challenges when adopting BD and BDA, including auditors' lack of adequate training and necessary skills to analyze big data; compatibility and truthfulness of data sources; shortage of fund in small and medium audit firms to invest in BDA.

The current study makes contributions to literature related to BD and BDA in the auditing profession. The research issues are emerging and there is limited number of studies conducted in developing countries. It is the first comprehensive study in Vietnam that utilizes qualitative methods to investigate the research issues.

The study also makes practical contributions for auditing profession in Vietnam. The results reveal the current practice of BD and BDA in audit firms in Vietnam and difficulties that audit firms in Vietnam have to deal with when implementing such kind of modern technology. The results of the study may be useful for audit firms and audit regulators in their decision- making processes.

This research contains some limitations. The responders' sample size is not large. Hence, the results may not be generalizable. If this topic is combined with the survey, the results of usage frequency will be easy to follow. This study is exploratory research, investigating the issues by a research method that few people do.

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