FACTORS AFFECTING THE ADOPTION OF BIG DATA ANALYSIS IN FINANCIAL AUDIT AT AUDIT FIRMS: A STUDY OF INTERNAL CONTROL

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Abstract

In audit firms as well as in other types of firms, big data is regarded as an emerging technology next time (Rosnidah et al., 2022). Big data analysis (BDA) is an emerging issue in auditing that is generating intriguing research questions (Hezam et al., 2023). The purpose of this research is to investigate external auditors' points of view related to their motivations behind adopting BDA in a developing country, Vietnam. We report on the level of adoption and challenges that audit firms are facing when implementing BDA technologies in Vietnam. This study reports findings from semi-structured interviews with 37 auditors in Vietnam, and we also use secondary sources of data. The results illustrate that, overall, client size, audit firms' strategies, and market competition are the key indicators for determining the implementation of BDA within audit firms in Vietnam. While Big Four accounting companies are at the initial stages of adopting BDA, the non-Big Four counterparts are yet to reach the adoption stage. We report that audit firms in Vietnam are facing challenges in implementing BDA, which include 1) lacking the skills and training required, 2) the relevance and reliability of the various data sources, and 3) a shortage of investment funding in small and medium accounting companies. Our contribution to the debate revolves around the dominance of the Big Four in global audit markets and its potential to reduce market competition.

Keywords: Big Data Analytics, Audit Firm Competition, Audit Techniques, Emerging Economies

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1. INTRODUCTION

One important component of high-quality financial reporting is auditing, which improves regulatory compliance, increases the efficacy of internal controls, and lessens information asymmetry (Fasoulas et al., 2024). Today, social media, cloud computing, and various online networks are increasingly connecting many audit systems and processes to external data sources (Hashem, 2023; Jameel et al., 2024). Big data analysis (BDA) is the procedure of looking through, cleansing, and modeling large amounts of data to find and share relevant reports, make recommendations, and aid processes of deciding (Cao et al., 2015). This research makes contributions to the auditing literature by showing results related to the developments of BDA from the points of view of auditors in a developing country, Vietnam. This will offer a fresh perspective on the advancements documented in the body of auditing knowledge (Al-Ateeq et al., 2022; Kend & Nguyen, 2020; Kend & Nguyen, 2022; Rosnidah et al., 2022).

Auditing is reportedly adopting BDA at a slower pace than other professions like consulting. This is due to concerns about liability and strict regulations in the audit environment; thus, audit firms are more careful when investing in BDA. However, various research studies (Liddy, 2014; Lombardi et al., 2014) indicate that BDA is the new trend in the auditing profession. According to Capriotti (2014), BDA has the potential to become the most important change in the auditing process when it comes to technology-based and paperless auditing. Big data creates massive changes in the way businesses operate. With the emergence of BDA, many jobs and tasks become obsolete (Richins et al., 2017). The Professional Society of Accountants and Auditors has recognized the increasing use of BDA by corporations and has made recommendations on its use in auditing (Eilifsen et al., 2020).

In order to assess company performance, the Big Four audit firms have recently made large investments in purchasing or creating new technology. One example is Deloitte's text mining tool, which allows them to extract crucial information from unstructured data (Fasoulas et al., 2024). Previous literature indicates that BDA could enhance the effectiveness and credibility of audit work (Lombardi et al., 2014; Kend & Nguyen, 2020). Other studies mention the ability to audit the whole population of transactions due to the implementation of BDA tools. In addition, it also helps auditors to improve risk assessment procedures and tests of control when conducting the financial statement audit (Alrashidi et al., 2022).

Research on BDA and its practical application in auditing lags behind other professions (Dagilienė & Klovienė, 2019). The application of BDA in auditing is an emerging research area in Vietnam, and the research on this issue is very limited. We undertook this study to fill this knowledge gap. Specifically, the study focuses on 1) investigating the indicators for the implementation of BDA in audit firms in Vietnam; 2) the current usage of BDA at Vietnamese auditing firms; and 3) the difficulties these audit firms encounter when applying BDA in the Vietnamese audit environment. This research may be crucial for legislators to regulate the auditing profession in Vietnam since it will provide practical circumstances of BDA in audit firms. Furthermore, audit firms can use the research outcomes to better plan and make decisions related to technology adoption.

We discuss previous studies on BDA in auditing in the following Section 2. This also contains specifics about the technology-organization-environment (TOE) theory. The study's research methods and data description are then described in Section 3. The findings section and an analysis of the findings are presented in Section 4. The ramifications of this study, including its limitations, are discussed in the study's final Section 5.

2. LITERATURE REVIEW

2.1. Previous research on big data analysis

John Mashey is the first person to utilize the term "big data" to illustrate the procedures of analyzing huge amounts of data. Laney (2001) argued that big data is characterized by several characteristics: quantity (including large amounts of data), quickness, and diversity. Other researchers have come up with more ideas about what makes big data unique. These include comprehensiveness (capturing the entire system instead of just a sample), details (in terms of resolution), relationality (holding common fields that allow different data sets to work together), extensibility (easily adding or changing new fields), authenticity, and value (gaining more insights and reusing data) (Kitchin & McArdle, 2016). The Institute of Chartered Accountants in England and Wales (ICAEW, 2019) suggests the notion of big data, including the huge amount, complication, pace, and diversity of data.

Earley (2015) conducted one of the first studies on BDA implementation within the audit environment with the purpose of identifying the implementation of BDA in the auditing profession and its transformation in the process of audit work. The research results highlight four primary advantages of implementing BDA in auditing: 1) the implementation of BDA in auditing enables external auditors to scrutinize a larger number of transactions, 2) it improves audit quality by providing deeper insights into the client's processes, 3) it streamlines fraud detection by utilizing existing tools and technology, and 4) it empowers external auditors to provide services and resolve client issues beyond their current capabilities using external data. Earley (2015) also reports the difficulties of implementing BDA in audit firms, which include 1) lack of instructions and competence, 2) relevance and reliability of data issues, and 3) expectations of regulators and users of financial reports. Earley (2015) also recommends that future research should focus on the challenges faced by auditors when dealing with such big data.

Richins et al. (2017) investigate the impacts of BDA on accounting and auditing work by utilizing a qualitative method. The findings demonstrate that BDA complements auditors' work rather than taking over their work. Auditors are mainly based on their professional judgment when conducting audits. BDA assists auditors in evaluating the whole set of financial data rather than auditing the sample of the data. The authors also express concerns over the challenges faced by auditors, including the credibility of data and the competition between technological firms.

Some leading companies have already started applying BDA. However, Gepp et al. (2018) review of

previous studies suggests that auditing underutilizes big data. The reason is that external auditors are hesitant to employ methods and technologies that go beyond those utilized by their customers. Gepp et al. (2018) recommend conducting future research on BDA to further harmonize this field's philosophy and practice, such as 1) exploring the implementation of BDA techniques and 2) studying the practical use across the audit industry.

In the Republic of Lithuania, Dagilienė and Klovienė (2019) studied the use of BDA among audit clients, independent audit firms, and state management agencies in tax, accounting, and auditing. They conducted in-depth interviews using qualitative methods with 21 auditors from auditing companies, data experts from audit clients, and managers from state management agencies. The study found that for audited clients, BDA is considered a tool to understand customer needs, risk management, and internal governance. The primary purpose of utilizing BDA in big accounting companies is to guarantee the quality of the audit and prepare appropriate auditing reports. This goal is often based on the audit firm's global information technology (IT) innovation strategy. Regulators lack experience in using BDA tools and anticipate an emerging direction in the next period. Dagilienė and Klovienė (2019) results also indicate various factors, some of which impact the utilization of BDA in the auditing stages. These direct factors stem from firm-related factors, particularly the data-driven strategy of accounting companies and the size of their customers.

Salijeni et al. (2019) employed qualitative methods, such as observation, the collection of internal and external documents from auditing companies, and in-depth interviews with 22 auditors in the UK, Belgium, and Italy, to investigate the effects of BDA on auditing practice and challenges related to BDA implementation in this field. The results indicate that the growing reliance of clients on BDA presents benefits for auditors to audit a large amount of data in their clients' software. Customers' increasing engagement with big data tools will lead to changing expectations about the type of audit procedures that fit with their systems. Serag and Al-Aqiliy (2020) conducted research on the role and significance of BDA for the auditing profession. This study also uses the TOE model to find out what indicators affect the use of BDA in each step of audit work. The results show that indicators for the utilization of BDA include 1) overcoming limitations in human perception compared to industrial information and 2) better workflow as utilization of BDA. The results also indicate that customers are concerned about data security. The more recent study by Salijeni et al. (2021) used qualitative methods, including observations, collecting internal documents from auditing firms, collecting external documents, and conducting interviews with 25 auditors in the UK, Belgium, and Italy. Their study focuses on understanding how the interaction between BDA and users affects auditing practices. The results indicate that BDA can automate large-scale audit processes, offering chances for the extension of audit evidence and insights in auditing jobs (increasing the level of detail when performing audits). Furthermore, BDA's intuitive dashboard has contributed to enhancing auditors' communication abilities in presenting audit results. Kend and Nguyen (2020) researched the impact of BDA, artificial intelligence (AI), and blockchain technology on the auditing profession in Australia by interviewing 20 auditors, audit clients, managers, and investors. The study's findings suggest that AI and BDA have a positive impact on the auditing profession, enabling auditors to provide greater assurance when auditing a larger sample size. However, their research results also show that BDA is not necessarily effective in all cases. De Santis and D'Onza (2021) analyze the utilization of BDA in financial statement audits, targeting the procedures of bringing BDA into audit practice around techniques in BDA, factors that promote or inhibit the adoption of BDA, and the actions auditors need to take to legitimize its use within and beyond the audit community. They conducted their study by interviewing senior managers of auditing firms in Italy. The findings reveal that the Big Four spearheads BDA-driven audit innovation, utilizing BDA to enhance traditional audit procedures. Slow digital maturity of audit clients, lack of audit standards, and negative views of audit watchdogs are factors hindering the adoption of BDA.

Now focusing on research from emerging economies, Alrashidi et al. (2022) study how BDA impacts the implementation of auditing processes at independent audit firms in the Middle East by surveying 361 auditors working in audit firms in the Middle East area. The research results convey that BDA is impacted by auditing processes at all stages, in which BDA makes contributions by helping auditors gain more knowledge of their customers, thereby influencing their decision to accept customers. Furthermore, by offering the necessary data, BDA allows auditors to perform analysis processes, risk evaluation, and assess internal controls more easily. Therefore, auditors need to enhance their skills and knowledge in BDA, as it adds benefits for themselves and their customers. In another study, Hezam et al. (2023), analyzed 100 international articles related to BDA published from 2011 to 2021 years. Their findings indicate that the use of BDA in auditing is not as advanced as it is in other professions. Their research also identifies eight problems that need to be fixed to enhance the quality of audits when BDA is used. These are 1) problems with the training and skills of auditors; 2) the chance that cyberattacks or a lack of data filtering tools could destroy audit data; and 3) job losses caused by the use of high-tech tools in auditing; 4) having to get and process a lot of data, which needs a lot of computer space and analytics software; 5) the ability of analytics software to deal with different types of data; 6) too much output can cause information overload, which can lead to bad decisions and interpretations; 7) auditors not having enough access to data and problems like data that isn't clear; and 8) the difference between what the public and regulators expect from auditing. Hezam et al. (2023) propose future research projects to focus on studying the driving forces behind the implementation of BDA and auditors' reactions to using BDA at audit firms. Future research should also focus on answering questions, including what skills and knowledge auditors need to have when applying BDA and how it helps auditors detect material misstatements.

In terms of research on BDA in Vietnam, Nguyen (2023) introduced the characteristics and trends of big data in auditing, but the new introductions stop at a very basic level and focus mainly on applications to state auditing.

Nguyen (2023) uses qualitative methods and data collected from articles and research around the world to study the benefits and challenges of applying in auditing. The study also highlights the challenges associated with applying data analysis in auditing, which include the training and specialization of auditors and the readiness, relevance, and integrity of data sources. Data analytics can exacerbate the problem of expectation gaps between regulators and financial reporting users.

In summary, BDA is an emerging topic in auditing, attracting interesting research issues related to BDA. Developed countries primarily conduct research on BDA. Both qualitative and quantitative research methods are employed. These studies are mainly exploratory in nature. Future research on BDA should better link theory and practical application, according to scholars. Research gaps include 1) investigating indicators that impact the implementation of BDA in the audit field, 2) examining the status of BDA implementation in the field, and 3) examining the challenges faced by auditing firms and the necessary solutions for implementing BDA. Developed countries primarily conduct research on BDA in auditing, while Vietnam still has limited research on this issue. In fact, further studies are urgently necessary to contribute to the promotion of audit quality in Vietnam.

2.2. Technology-organization-environment framework

Tornatzky et al. (1990) established the TOE framework. To examine the elements influencing an organization's implementation of innovative equipment, the TOE framework offers three primary features (Chiu et al., 2017). The technological feature describes the technologies available in organizations and available technologies in the market. The organization features pertain to the organization's size, scope, managerial systems, employees, and other internal sources. The environmental features include the company's competitors, customers, and interactions with the government (Tornatzky et al., 1990). Previous studies demonstrate the adoption of technical innovation is impacted by technological aspects, comprising technical support, availability and compatibility of technical tools, software, and suppliers' aids. Some researchers conclude that the TOE framework is better than most others because it gives a fuller picture of adoption reasons problems, and activities along the processes of implementation (Awa et al., 2016).

Zhu and Kraemer (2005) determined that technical expertise, company magnitude, firm guarantee, fiscal stress, and legal support are significant factors inside the TOE framework. Thong (1999) concluded that the enactment of innovative technology is significantly motivated by technological and organizational features. Henriksen (2006) stated that environmental and organizational elements are more substantial than technological elements.

The justifiable capability of the TOE framework was shown in earlier studies. Numerous studies into cutting-edge innovation, including cloud computing, e-commerce, online services, and information systems selected the TOE as their framework. The TOE framework serves as the theoretical foundation for this study, which focuses on the implementation of cutting-edge technology from the viewpoint of audit businesses (Awa et al., 2016).

Li et al. (2018) presented the theoretical framework of analysis implementation in an audit based on TOE theory. Technological elements include things like IT complexity and technical proficiency. The environmental features cover the context that a company does business in, consisting of the surrounding businesses, competitors, and the relation with the regulatory bodies. Organizational features offer descriptive metrics of firms, such as scope and managerial strategies.

A variety of models, including the theory of planned behavior (Ajzen, 1991), the unified theory of acceptance and use of technology (Venkatesh et al., 2003), the technology acceptance model (Venkatesh & Davis, 2000), and the TOE framework, can study IT usage. TOE functions at the organizational level, whereas the previous three models examine the technological implementation of each person. Two factors led us to select the TOE framework. First, we must use the TOE framework to focus on the post-adoption stage, as it identifies factors that influence not only the acceptance of technical advances but also their implementation and use. The TOE paradigm is also good for looking at the factors that affect how audit firms use audit analytics since it looks at how technology is used in a business setting, not just individual auditors (Li et al., 2018).

3. RESEARCH METHODOLOGY

Several studies on BDA utilize quantitative methods for data collection (Alrashidi et al., 2022; Al-Ateeq et al., 2022; Serag & Al-Aqiliy, 2020). Recently, Hashem (2023) conducted a survey among financial managers to assess the impact of electronic audits on the trustworthiness and legitimacy of financial data. Other streams of research adopt qualitative methods to investigate the BDA issues in different countries around the world (Earley, 2015; Richins et al., 2017; Gepp et al., 2018; Dagilienė & Klovienė, 2019; De Santis & D'Onza, 2021).

Following the methods adopted by Kend and Nguyen (2020), the present study gathered and analyzed data using a qualitative methodology. Techniques for gathering data from various sources for this study included secondary documents, additional sources, and semi-structured interviews (Kvale & Brinkmann 2009). The current study implements in-depth interviews for data collection due to several reasons. Firstly, the researchers can start by asking a series of questions intended to extract data for a certain goal. Second, the researchers can successfully regulate the discussion by using an approach of in-depth investigation. Lastly, an in-depth interview inspires respondents to share as much information as they. The researchers can ask for examples or explain the responses in order to fully understand the respondents' ideas. By offering details and context to clarify conflicting viewpoints and interpretations of events, an in-depth interview aims to acquire more in-depth understanding. During such interviews, respondents are free to voice their opinions and use their own language (Kvale, 1996).

To select participants for the current study, the researcher employed the purposive sampling technique. The researcher has about twenty years of experience in the auditing field. Based on a practical understanding of the research field, the researcher

actively chose the most fruitful sample (Marshall, 1996).

Purposive sampling is a method in which the researchers choose respondents who exhibit certain predetermined characteristics (Luborsky & Rubinstein, 1995). To choose participants for the current study, the researcher developed the following criteria: the requirements for participants included employment in Vietnam, a minimum age of 30 years old, a Bachelor's degree, and a minimum of five years of auditing experience. Interviewed external auditors who have experience across various audit client industries and actively participate in auditing clients ranging from small to large companies.

The respondents include 37 auditors. We gathered data in person through face-to-face office interviews between March 2023 and April 2023. We immediately set up interview appointments after participants gave their consent for contact. Participants then received formal invitation letters, interview questions, and consent forms via email three to five days before the interviews. The goal was to give the interviewee time to consider the subject of the study. Before starting each interview, the researcher gave a brief introduction, described the nature and goal of the study, and went over the information in the respondents' consent form and invitation letter. The researcher filled in each interviewee's background details. The researcher used the interview questions, which contained probes, follow-up questions, and key questions, as well as the interview rules. Each interview lasted between 50 and 70 minutes.

Table 1. Details of respondents (from accounting firms in Vietnam, N = 37)

Position	*N*	*Destination*	*Time of interviews (min)*	*Big Four (N = 15)*	*International mid-tier (N = 13)*	*Domestic firms (N = 9)*
Team leader	10	Hanoi	50–70	4	4	2
Team leader	6	Ho Chi Minh	50–70	2	2	2
Audit managers	7	Hanoi	50–70	3	2	2
Audit managers	5	Ho Chi Minh	50–70	2	2	1
Audit partners	5	Hanoi	50–70	2	2	1
Audit partners	4	Ho Chi Minh	50–70	2	1	1

The researcher used websites and published papers in Vietnamese as additional information sources for this investigation. This study applied a qualitative data analysis technique known as thematic analysis (Braun & Clarke, 2006).

4. FINDINGS AND DISCUSSIONS

4.1. Factors affecting the implementation of big data analysis

The findings from secondary data and interviews illustrate that the scope of customers is the most common indicator impacting the use of BDA in accounting firms. Smaller customers' data is inherently not characterized by big data features. When working with smaller customers, all external auditors find MS Excel to be the most efficient tool for data analysis. In these situations, using BDA software is not required. Large groups and multinational corporations are major drivers because they frequently have access to massive transactions. Thus, BDA can assist audit firms in finding ways to audit them.

"*We are considering the use of data analysis software to manage large datasets. Using MS Excel to check the big data doesn't make sense. We could not use Excel to check the big amount of financial data. Therefore, BDA software is needed with a large dataset in big audit clients*" (large, non-Big Four audit firms, an audit partner, personal communication, March 23, 2023).

The results align with the findings of Dagilienė and Klovienė (2019). Data originates primarily from audit clients, as the number of large groups continues to increase. Large auditing customers usually employ big data first, then audit firms follow. The results also demonstrate the environmental influence of the TOE on the implementation of technological modernization. The implementation of BDA in audit firms comes from the audit client's data characteristics and external factors (Awa et al., 2016).

The global audit firms' strategy is an internal factor that impacts the implementation of BDA. Being a member of an international network presents a significant task in the implementation of BDA in their work. Big Four accounting companies in Vietnam are adopting BDA with large customers who often have big data sets. Under pressure from their parent firms overseas, large audit firms in Vietnam, which are not part of the Big Four, also have the intention to utilize BDA. Top managers from global firms are supporting the implementation of BDA, prompting accounting companies that are part of a global network to introduce BDA as their audit tool. This aligns with the organizational context factor of TOE theory, where the company strategy encourages the employment of innovative techniques (Chiu et al., 2017).

"*Only the leading enterprises in their industry have big data. Small businesses do not have access to big data. Vietnamese businesses still primarily rely on Fast (accounting software). Large audit clients have big data. Currently, my audit firm does not use big data and does not have data analysis software. However, we must employ it in the future. My audit firm is a member of HLP* [a global network of independent advisory and accounting firms]. *In the future, my audit firm will need to keep pace with the global trend of big data and BDA*" (large, non-Big Four audit firms, an audit manager, personal communication, April 3, 2023).

Competing in the auditing market is another important factor to consider. International networks of the biggest audit firms gave BDA a favorable evaluation and saw it as a long-term benefit in the market. The Big Four audit firms improve their competition capacities by investing in big modern data analysis software. The findings are consistent with the results of Salijeni et al. (2019). Accounting companies utilize BDA as a method to expand the work they offer to their clients. The findings are consistent with the findings of Dagilienė and Klovienė (2019). The biggest audit firms (global networks) viewed BDA favorably and saw it as a long-term competitive benefit in the audit market.

"*We operate exclusively in the electronic realm. Therefore, we are well-positioned to be winners in the market"* (Big Four firm, an audit manager, personal communication, March 24, 2023).

Our findings align with the environmental factors outlined in the TOE framework. Competitive pressure has impacted the adoption of technological innovation, and modern technologies have changed the ways to compete and reorganize the auditing industry (Awa et al., 2016).

4.2. Practices of utilizing big data analysis in external audits in Vietnam

4.2.1. Larger non-Big Four accounting companies

Our findings show that large accounting companies outside the Big Four still conduct their audits mainly by MS Excel. However, almost all these firms have an intention to adopt BDA next time under the pressure of their parent companies.

"*Only the industry's leading enterprises possess business data analytics (BDA). Small businesses also lack access to big data. Vietnamese businesses primarily rely on accounting software such as Misa. Large audit clients have big data. Currently, my audit firm does not use BDA and therefore does not have data analysis software, but we will need to update it in the future. My audit firm is a member of HLP. In the future, my audit firm will also need to align with the global trend set by BDA*" (large, non-Big Four firms, an audit partner, personal communication, April 10, 2023).

4.2.2. Smaller non-Big Four accounting companies

Small accounting companies audit their customers by utilizing MS Excel. According to respondents from these firms, their customers' data is not big. Therefore, BDA tools are not needed in their audit work.

"*Our company uses MS Excel for audit work instead of audit software. Our company also saves its working papers on MS Excel. We save working papers in MS Excel during the season and print them out once it ends. Our company does not possess large datasets or analytical software. Our audit clients are all small"* (small audit firms, a team leader, personal communication, April 12, 2023).

Respondents also state their accounting companies have no BDA plans beyond now.

"*We audit on MS Excel; we do not use audit software. We extract the data from the customer's accounting software and then export it to MS Excel. My audit firm lacks both big data and the software necessary for its analysis. Big data remains a challenging issue for us. We do not have any plans to adopt BDA*" (medium audit firms, an audit manager, personal communication, April 15, 2023).

The reason given to the researchers is that these audit firms' clients are small or medium-sized. These audit clients do not have big data sets. Lack of experience and insufficient funds to invest in BDA are further factors.

"*We do not have enough funds to pour money into those things. We do not make a lot of profit since our audit fees are not high*" (small audit firms, an audit partner, personal communication, April 18, 2023).

4.2.3. The Big Four audit firms

Recently, the Big Four accounting companies are increasingly investing in emerging technologies, and they believe that integrating big data into BDA is the key to success. Each of the Big Four accounting companies has poured a substantial sum of money into developing or purchasing BDA products in recent years. For instance, Ernst and Young has invested US$400 million in the development of new audit support technologies such as BDA (Salijeni et al., 2019).

The findings show that the Big Four accounting companies have started BDA tools in their audit work at the beginning stage. Nevertheless, the use of BDA remains restricted to large audit clients with well-recorded data and transactions. Other clients of Big Four auditors who do not have properly recorded and presented transactions are less likely to have data suitable for BDA tools.

"*My audit firm utilizes BDA software already with the customers who have big data. However, the data must be compatible with our BDA software*" (Big Four firms, a team leader, personal communication, April 20, 2023).

In terms of other customers, the Big Four accounting companies still employ MS Excel to audit financial statements.

"*In fact, I believe that this data analysis software is more beneficial for customers who utilize ERP* [enterprise resource planning] *and SAP* [system application programming], *as it provides a wealth of useful information. For example, the Fast software used by Vietnamese customers is relatively minimal, containing only basic data fields. When I attempt to run it, it yields results. However, it lacks optimization, and its use is limited merely to customers with large data sets that Excel cannot handle. With current audit clients, we continue to primarily utilize Microsoft Excel*" (Big Four firm, an audit manager, personal communication, April 22, 2023).

The Big Four accounting companies have experts in BDA tools, who often cooperate with financial auditors about data analysis. Financial auditors do not have sufficient experience to analyze big data.

"*Our firm has a special team in big data analysis, who are very good at BDA software*" (Big Four firm, a team leader, personal communication, April 25, 2023).

"Our firm aims to integrate all information into its data analysis software next time. Forecasts indicate that the business's data will increase annually. For instance, foreign direct investment (FDI) firms have a complex and large-scale system, and they already possess significant amounts of data" (Big Four firm, a team leader, personal communication, April 27, 2023).

In general, the findings illustrate that while Big Four accounting companies have started utilizing the BDA tools, non-Big Four accounting companies have not started such modern tools yet. The findings also indicate the implementation of BDA depends on the size of accounting companies, which is aligned with the organizational feature of the TOE theory and framework. The scope of a firm impacts the implementation of innovative equipment (Skafi et al., 2020).

4.3. Difficulties encountered by accounting companies when implementing big data analysis

4.3.1. Insufficient instructions and the required abilities

Respondents state that financial auditors have insufficient abilities to utilize BDA tools, such as regression techniques. In the Big Four accounting companies, they have experts who specialize in BDA tools that can cooperate with financial auditors in an audit engagement. In other cases, these accounting companies could hire outside data scientists to deal with BDA. These companies also get training from outside experts. The findings indicate financial auditors' insufficient ability and expertise to conduct BDA. The results show the employee knowledge factor of the organizational context of TOE theory. Employee knowledge is important in the implementation of innovative technology (Chiu et al., 2017).

"*BDA is a unique thing to us, and most of us currently lack the necessary skills to analyze it*" (Big Four firm, an audit manager, personal communication, April 20, 2023).

The findings are aligned with those of Hezam et al. (2023). According to Hezam et al. (2023), the auditors' insufficient abilities and expertise in BDA pose a significant challenge for audit firms. The results also suggest that there is a need to enhance auditors' BDA training. It's challenging to find aspiring auditors who are already skilled with big data. Accounting modules at educational institutions ought to emphasize data capabilities and promote collaboration between the IT and accounting domains. To improve the auditor's understanding and proficiency in data analysis, audit companies and their customers should organize regular training sessions or seminars. Additionally, they must permit the auditors to train across departments and move between many roles. Here, the role of regulatory bodies is crucial, as new standards for professional examinations have the potential to alter the content of accounting education (Nguyen, 2023). "*We need deep training in the near future*" (Big Four firm, a team leader, personal communication, April 29, 2023).

The results are also consistent with the technology features of the TOE framework. According to Rosnidah et al. (2022), the technology aspects of the TOE framework related to the employment of BDA include IT complexity and technological competence. Auditors must be knowledgeable about both fundamental and advanced approaches, as well as their advantages and disadvantages, in order to attain a great level of BDA utilization. For instance, auditors frequently use simple data analysis when conducting audits but lack the techniques and expertise to utilize sophisticated methods. Therefore, during the initial stages of BDA adoption, auditors may lack the necessary skills and require immediate training and support from professional bodies and regulatory bodies. Professional and regulatory bodies (the environmental features) need to facilitate the implementation of BDA.

4.3.2. Compatible and truthful data

The respondents indicate that in some cases, the data is not compatible and matches BDA tools. Therefore, auditors need to clean the data before putting it in the BDA software. In some cases, it takes a lot of time to clean up the data.

"*The process of extracting data from various tables, which might not match with our BDA software, often necessitates significant manual labor to ensure its accuracy*" (Big Four firm, an audit partner, personal communication, April 21, 2023).

There are also concerns over the confidentiality of data. "*The client may collect data, but it's unclear how much the auditor can access or share it. Many clients do not allow auditors to directly access their database*" (Big Four firm, an audit manager, personal communication, April 25, 2023).

The findings show that there are instances where the BDA software in audit firms and the big data from audit clients are incompatible, posing challenges for both auditors and audit firms. Compatibility is a factor of technology context in the TOE theory, IT complexity. Hence, the results indicate that compatibility is the technology factor that negatively affects the implementation of BDA in some cases.

4.3.3. Insufficient financial resources

Small and medium-sized accounting companies encounter challenges related to finance to invest in BDA tools. The secondary data shows that BDA could bring benefits to accounting companies. However, those companies could not afford it due to a lack of financial resources.

"*We lack sufficient funds to invest in big data analytics, as our audit fees are significantly lower than those of large audit firms*" (small audit firm, an audit partner, personal communication, April 12, 2023).

"The price of BDA is significantly higher than its benefits. We lack the financial resources to invest in such initiatives, and we currently do not require BDA services. Because our audit clients are small, we can conduct audit processes effectively using MS Excel" (small audit firm, an audit manager, personal communication, April 10, 2023).

The findings are aligned with Serag and Al-Aqiliy (2020) and Dagilienė and Klovienė (2019). These authors highlight the financial challenges that small accounting companies face in adopting BDA. According to Rosnidah et al. (2022), organizational aspects of the TOE framework related to the usage of BDA include management attitude and size of organizations. Small businesses lack the finance to purchase pricey BDA technology.

5. CONCLUSION

The researchers determine the indicators for the employment of BDA by accounting companies in Vietnam; the current circumstance of BDA implementation in these companies; and the obstacles that these companies encounter in implementing BDA. We found that there are several issues related to the adoption and implementation of BDA in Vietnam's emerging economy. The results indicate that the scope of accounting companies is considered the significant indicator impacting the employment of BDA. When it comes to using BDA, only large auditors typically take the lead, whereas smaller audit companies follow. Another significant factor driving the adoption of BDA by auditors is their global strategy. Finally, one

important consideration is the degree of competition in the auditing industry. It is evident that the biggest accounting companies, referred to as international firms, give the BDA a positive evaluation and see it as a benefit for a long period of time when they compete in this industry.

Regarding the application of BDA in practice today, auditing is lagging behind other professions. In Vietnam, only Big Four accounting firms have begun using BDA with certain types of customers; non-Big Four accounting firms have not done so yet. The use of BDA presents challenges for Vietnamese audit firms, such as the insufficient training and expertise of auditors to evaluate big data, the unreliability and compatibility of information gathered, and the lack of funding available to small-sized accounting companies to pour money into BDA.

Our research adds to the body of knowledge about BDA in the auditing industry. We are studying emerging research concerns, a phenomenon uncommon in underdeveloped nations. It is the first thorough study of this topic in the emerging economy of Vietnam, using qualitative techniques to explore the research questions. We report useful insights for Vietnam's auditing industry as well. The findings illustrate the use of BDA in Vietnamese auditing firms and the challenges these organizations encounter in integrating this cutting-edge technology. In making decisions or setting policies, external auditors and audit regulators may find our study's findings helpful.

There are limitations to this study. The number of respondents in the sample is not large. Therefore, the findings may not be generalizable. If we integrate a survey, we can easily interpret the usage and frequency of our results. It is a qualitative study, and future studies should incorporate survey methodology to assess the auditors' degree of use of BDA and relevant analytical techniques and skills.

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