Revista de Educação e Pesquisa em Contabilidade
Journal of Education and Research in Accounting

Periódico de Publicação Contínua, digital e gratuito publicado pela Academia Brasileira de Ciências Contábeis | Disponível online em www.repec.org.br

REPeC, Brasília, v. 19, 2025 | DOI: http://dx.doi.org/10.17524/repec.v19.e3687 | ISSN 1981-8610

Adoption of emerging technologies in a regulated environment: a study in audit companies

Paolo Giuseppe Lima de Araujo
https://orcid.org/0000-0002-6120-7713

Lorena Costa de Oliveira Araujo
https://orcid.org/0000-0002-3436-5505

Samuel Façanha Câmara
https://orcid.org/0000-0002-8333-6997

Abstract

Objective: Analyze the moderating role of the environmental context in the relationship between technological and organizational contexts and audit firms' adoption of emerging technologies in a regulated environment.

Method: This descriptive study was conducted using a quantitative survey. The population consisted of audit firms registered with the Securities and Exchange Commission. A sample of 114 valid responses was obtained. Structural Equation Modeling (PLS-SEM) and moderation analysis using the product indicator method were performed.

Results: The findings confirm the theoretical foundation of this study, the Technology, Organization, and Environment (TOE) framework, demonstrating that a company's technological, organizational, and environmental contexts influence audit firms' decisions regarding the adoption of emerging technologies. Concerning the moderating role of the environmental context, the results suggest that coercive and mimetic pressures do not play a moderating role. In contrast, normative pressure positively moderates the relationship between the technological and organizational contexts and the adoption of new technologies.

Contribution: The predictive power of the TOE framework in audit firms' adoption of emerging technologies was empirically validated. Additionally, in the theoretical field, the study advances the discussion on the factors influencing the adoption of new technologies by audit firms within the Brazilian regulatory environment.

Keywords: Adoption of emerging technologies. TOE Structure. Audit.

Published in Portuguese and English. Original Version in Portuguese.

Round 1: Received in 1/11/2024. Review requested on 3/26/2024. Round 2: Resubmited on 4/25/2024. Review requested on 4/29/2024. Round 3: Resubmited on 4/29/2024. Accepted on 5/21/2024 by Vinicius Gomes Martins, PhD (Editor assistant) by Gerlando Augusto Sampaio Franco de Lima, PhD (Editor). Published on 3/31/2025. Organization responsible for the journal: Abracicon.

1 Introduction

An accountant's role in the accounting profession has traditionally centered on calculation, transaction recording techniques, and information generation (Henry & Hicks, 2015). However, the profession is evolving due to technological advancements, and auditing firms, a branch of accounting, have to adapt to these changes.

Digital transformation is characterized by the use of digital technologies to reshape businesses, identify new revenue opportunities, and enable or enhance business models and processes (Majchrzak *et al.*, 2016).

Consequently, digital transformation presents numerous significant research opportunities in auditing, including understanding the factors that influence audit firms' decisions to adopt new technologies, identifying market-driven requirements for auditors regarding knowledge and service provision as clients implement more complex computerized systems, exploring how emerging technologies can be leveraged for data analysis and auditing, and examining the impact of these technologies on auditors' work (Witte, 2020).

The emerging technologies most commonly adopted by auditing firms to enhance their processes and services include big data, artificial intelligence (AI), robotics—such as robotic process automation (RPA), cognitive automation, and virtual assistants—intelligent automation for self-regulating task handling, cloud computing, blockchain, drones, the Internet of Things (IoT), 3D printing, and computer vision (Montes & Goertzel, 2019).

Several studies have explored the impact of emerging technologies on companies, including research on big data and AI in data analysis (Warren *et al*., 2015) and external reporting (Al-Htaybat & Von Alberti-Alhtaybat, 2017); the effects of digital technology on audit firm performance and risk analysis (Cao *et al*., 2015); the influence of these technologies on the quality of auditor judgments (Brown-Liburd & Vasarhelyi, 2015); the adoption of digital transformation and data analytics in the internal audit environment (Vasarhelyi *et al*., 2015); and the role of digital technology in transforming audit firms and the audit process (Appelbaum & Nehmer, 2017).

Studies examining the factors influencing the adoption of new technologies include Widuri *et al.* (2019) and Handoko and Thomas (2021), who analyzed the adoption of audit software; Eu-Gene *et al.* (2019), who investigated the use of Computer-Assisted Audit Tools and Techniques (CAAT); Widuri *et al.* (2019), who explored the adoption of Generalized Audit Software (GAS); and Handoko (2021), who focused on the adoption of machine learning. However, there remains a research gap regarding the factors influencing the adoption of emerging technologies—such as AI, big data, RPA, cloud computing, blockchain, drones, the Internet of Things (IoT), and Audit Data Analytics (ADA)—in the context of external auditing, highlighting the relevance of this study.

Regarding the theoretical foundation supporting studies on digital transformation, the Technology, Organization, and Environment (TOE) framework is widely applied to research on the adoption of information technology at the company level (Oliveira & Martins, 2011; Venkatesh & Bala, 2012). Oliveira and Martins (2011) argue that the TOE model is particularly suitable for studying organizational technological innovations, as it incorporates the environmental context, making it a more comprehensive approach. They also emphasize that the TOE model has a solid theoretical foundation, strong empirical support, and significant potential for studying IT adoption. Furthermore, they suggest that for a more robust analysis of new technology adoption, integrating multiple theoretical models is essential to gaining a deeper understanding of the IT adoption phenomenon (Oliveira & Martins, 2011).

The TOE model posits that three key factors within a company's context influence decisions regarding the adoption of emerging technologies: the technological context, the organizational context, and the environmental context (Baker, 2012).

The technological context involves analyzing internal and external characteristics that are strategic for adopting emerging technologies. The organizational context encompasses factors such as company size, trust, information technology expertise, and knowledge of how to use emerging technologies. The environmental context refers to the external business environment, shaped by industry characteristics, competitive pressure, and trust (Tornatzky & Fleischer, 1990; Baker, 2012).

Despite the strong predictive power of the TOE model in studies on the adoption of emerging technologies, findings in the literature suggest that, in the context of auditing firms, the direct relationship between the environmental context and the adoption of emerging technologies has weak predictive power (Rosli *et al.*, 2016).

Thus, these findings suggest that the environmental context acts as a moderating variable due to the complexity of the auditing environment in Brazil, which is regulated by the Federal Accounting Council (CFC) and the Securities and Exchange Commission (CVM) regarding technology procedures and applications. Additionally, the significant role of auditors in ensuring the proper functioning of the capital market further influences the relationship between the technological and environmental contexts and the adoption of emerging technologies (Oliveira *et al*., 2019).

Given the conflicting findings on the adoption of emerging technologies within the environmental context and its potential influence on the relationships between the technological and organizational contexts, this study aims to analyze the moderating role of the environmental context in the relationship between the technological and organizational contexts and the adoption of emerging technologies by auditing firms in a regulated environment. Additionally, the direct relationship between the technological, organizational, and environmental contexts and the adoption of emerging technologies was examined to validate the theoretical framework adopted in this study.

The relevance of this study lies in providing insights about into the factors influencing audit firms' adoption of emerging technologies, regulators' perceptions of auditors, and how firms shape the use of advanced analytics software (Eilifsen *et al*., 2020). A perceived lack of sufficient audit standards to address these concerns heightens auditors' hesitation to adopt advanced analytics and other digital transformations (Barr-Pulliam *et al*., 2021). Although current auditing standards do not prohibit the use of emerging technologies, audit firms fear that the absence of specific regulations could lead to increased regulatory scrutiny (Barr-Pulliam *et al*., 2022) and heightened legal liability in the event of an audit failure (Barr-Pulliam *et al*., 2021). Therefore, this study contributes by proposing a comprehensive framework for adopting emerging technologies by audit firms, incorporating new variables such as coercive pressure, mimetic pressure, normative pressure, potential absorptive capacity (acquisition and assimilation), and realized absorptive capacity (transformation and application).

2 Theoretical Framework

2.1 Adoption of emerging technologies in auditing – a systematic literature review

Digital transformation is conceptualized as the impact of multiple digital innovations, introducing new structures, practices, actors, beliefs, and values that have the potential to challenge, modify, replace, or complement existing organizational and/or industry rules (Hinings *et al.*, 2018).

Digital innovation can transform markets by disrupting existing products and business models (Hinings *et al.*, 2018). Consequently, it plays an increasingly crucial role in achieving business objectives, often leading to the restructuring of entire industries (Grover & Kohli, 2012).

Research conducted by Kroon *et al.* (2021) aimed to identify the most frequently studied emerging technologies in relation to their impact on accountants' roles and skills. The results indicate that the primary technologies examined include data analytics (Salijeni *et al.,* 2019), blockchain (Pimentel & Boulianne, 2020; White *et al.*, 2020), and AI (Li & Vasarhelyi, 2018; Rozario & Vasarhelyi, 2019b; Sun, 2019).

Research strategies for adopting emerging technologies such as data analytics, blockchain, and AI in the auditing field have been primarily conceptual, with no empirical studies identified on their use. Given the limited number of studies on these technologies, this study focuses on the adoption of the following emerging technologies: robotic process automation (RPA), data analytics (DA), and blockchain.

Robotic Process Automation (RPA) is low-cost, easy-to-implement software designed for process automation (Huang & Vasarhelyi, 2019). Due to its characteristics, RPA can reduce costs associated with errors and task execution time by minimizing human involvement in repetitive and high-volume processes (Santos *et al.*, 2020). Despite the observed impacts of RPA, Cooper *et al*. (2019) noted a lack of studies analyzing RPA as a phenomenon in the context of accounting and auditing.

Artificial intelligence (AI) is the field of developing computer systems capable of achieving human-like intelligence through cognitive automation, machine learning, reasoning, hypothesis generation and analysis, natural language processing (NLP), and intentional algorithm modification (Rozario & Vasarhelyi, 2019b). Research on AI in auditing primarily focuses on the use of virtual assistants and cognitive technologies to develop cognitive aids for auditors (Li & Vasarhelyi, 2018), applying NLP to process audit-related textual information, such as contracts and social media (Rozario & Vasarhelyi, 2019a); combining NLP and deep learning to extract sentiment features from documents (Sun, 2019; Sun & Sales, 2018); employing machine learning algorithms for predictions and analyses; and utilizing image recognition in audit procedures, including the use of drones (Ding *et al.*, 2020).

Audit Data Analytics (ADA) is the science and art of discovering and analyzing patterns, identifying anomalies, and extracting other useful information from underlying or subject-related data through analysis, modeling, and visualization to support audit planning and execution (AICPA, 2014).

ADA in auditing primarily focuses on risk assessment, daily journal entry testing, and examining entire populations within a given area (Salijeni *et al.*, 2019). It also supports audit evaluation and the preparation of financial statements (Austin *et al.*, 2019) while enabling a significant increase in the volume of tests by analyzing complete data sets rather than samples (Austin *et al.*, 2019).

Blockchain is a distributed, decentralized, transparent, and chronological database that maintains a continuously growing list of data records organized into blocks. Each block is linked to the previous one and is verified by network participants ("nodes") to ensure its legitimacy. Data can be recorded in public and private ledgers containing transactions that have already occurred and been validated. Information about each transaction is shared and accessible to all nodes in the network. Additionally, nodes may operate anonymously, enhancing security in transaction verification (Inghirami, 2018).

Research on the relationship between blockchain and auditing primarily focuses on the challenges audit firms face in accepting new clients who use blockchain technology due to the lack of regulations defining what constitutes sufficient and appropriate audit evidence (Pimentel & Boulianne, 2020).

Studies on emerging technologies, including RPA, AI, ADA, and blockchain, have not examined the adoption process of these technologies by auditing firms. Instead, they have primarily focused on how these technologies can support auditors in audit processes and procedures by reducing costs, increasing the volume of tests, and automating repetitive tasks.

The TOE framework was used to examine audit firms' adoption of emerging technologies.

2.2 Technology, Organization, and Environment (TOE) Framework

Tornatzky and Fleischer (1990) developed the Technology, Organization, and Environment (TOE) framework to describe the factors influencing an organization's adoption of technological innovations. This model identifies three key aspects that influence the adoption and implementation of new technologies: the technological context, which includes internal and external factors related to technologies; the organizational context, which encompasses characteristics such as scope of operations, size, and management structure; and the environmental context, which considers the business environment in which a company operates, including market segment, competition, and government relations (Baker, 2012).

The TOE framework enables researchers to understand the broader context of innovation by integrating the various factors influencing technology adoption within their respective domains (Venkatesh & Bala, 2012). The technological, organizational, and environmental contexts shape technology adoption at the firm level (Tsou & Hsu, 2015) and influence how organizations adopt and implement technological innovations (Tornatzky & Fleischer, 1990).

In this study, the technological context was measured through technological competence, which encompasses technology infrastructure and IT human resources (Tsou & Hsu, 2015). Technology infrastructure refers to equipment such as computers, servers, intranets, and extranets that enable the use of emerging technologies (Zhu & Kraemer, 2005). IT human resources include information technology and auditing professionals with the knowledge and skills necessary to implement emerging technologies in auditing firms (Zhu & Kraemer, 2005).

Low *et al*. (2011) state that emerging technologies become part of a company's operational activities only if the necessary infrastructure and technical efficiency are in place. Thus, audit firms with technological competence are better prepared to adopt emerging technologies.

After reviewing the literature, Arpaci *et al.* (2012) noted that the TOE framework can be combined with other theories to explain IT adoption. They argue that Institutional Theory when integrated with the TOE framework, can provide a more comprehensive explanation of IT adoption across different contexts. Oliveira *et al.* (2019) offer examples of studies that combine Institutional Theory with the TOE framework.

Institutional Theory has been applied in research on information systems due to its relevance in understanding new technologies' organizational and social aspects. In general, studies focus on innovation, adoption, implementation, and assimilation, examining the impact of institutional pressure on the diffusion of IT innovations, the institutionalization of software applications, and the interaction between IT artifacts and existing institutions (Dedoulis, 2016).

The dimensions of Institutional Theory are typified as coercive, normative and mimetic (Dimaggio & Powell, 1983).

Coercive pressure captures the broader external pressure on a company to behave in a certain way (Dedoulis, 2016). The actions of the government or regulatory entities on organizations, represented by laws, standards and tax requirements, interfere with an organization's production patterns, behavior, and relationship with consumers (Freitas & Guimarães, 2007).

Normative pressure arises when a professional body—linked to professionalization (Coraiola & Silva, 2008) and composed of norms and rules governing institutions—establishes quality standards for specific organizational processes (McKinley & Mone, 2003). It also involves disseminating a shared cognitive framework, standard guidelines, and organizational practices (Dedoulis, 2016).

Mimetic pressure occurs when an organization facing uncertainty imitates the actions of and adopts practices from successful organizations (McKinley & Mone, 2003). In this context, uncertainty serves as a driving force. Therefore, even in situations free from uncertainty and/or difficulty, organizations may favor structures or practices already employed by institutions perceived as successful within the industry (Carpenter & Feroz, 2001).

Studies on technology adoption include absorptive capacity, along with managerial support and organizational size, as a factor in measuring the organizational context (Pivar, 2021).

Absorptive capacity encompasses elements related to gaining competitive advantages through investments in information technology (IT infrastructure) and personnel training (Sancho-Zamora *et al.*, 2022). It is defined as a company's ability to acquire and effectively utilize both external and internal knowledge, thereby creating opportunities for improved outcomes (Cohen & Levinthal, 1990).

Zahra and George (2002) conceptualize absorptive capacity in two components: potential absorptive capacity, which includes the dimensions of knowledge acquisition and assimilation, and realized absorptive capacity, which encompasses knowledge transformation and application.

Firms may face significant barriers to adopting IT innovations, such as a lack of absorptive capacity among workers (Park *et al.*, 2007). Tu *et al.* (2006) stated that absorptive capacity enables firms to expand their knowledge and skill base, enhancing their ability to support future information systems development.

Absorptive capacity can influence companies to adopt emerging technologies by identifying new technologies that enhance operations (acquisition), assimilating the necessary skills and competencies for more efficient adoption (assimilation), increasing flexibility and adaptability to changes, allowing experimentation with emerging technologies and operational adjustments (transformation); and effectively applying these technologies to improve efficiency, reduce costs, and enhance service quality (exploitation) (Zahra & George, 2002).

The business environment is characterized by institutionalism and ambiguity, which can present opportunities, such as new technologies and resources, and constraints, such as regulatory influences on decision-making (Bradley *et al.,* 2011). The IT literature indicates that Institutional Theory strengthens the environmental context within the TOE framework (Oliveira & Martins, 2011).

Institutional Theory suggests that a company's decision-making extends beyond purely rational considerations and is shaped by its institutional context. Firms seek to maximize their legitimacy in decision-making by aligning with their institutional environment and justifying their choices accordingly (Cui & Jiang, 2012). Studies integrating Institutional Theory with the TOE framework highlight its effectiveness in emphasizing environmental drivers (Tajudeen *et al.*, 2017).

As previously mentioned, the pressures outlined in Institutional Theory are considered significant determinants of technology adoption. However, Institutional Theory does not account for the technological and organizational contexts or factors influencing the adoption process. Integrating Institutional Theory with the TOE framework addresses this gap (Depietro *et al.,* 1990) and enhances the conceptual model's explanatory power (Oliveira *et al.*, 2019).

Although research indicates a direct influence of the environmental context on the adoption of audit technologies (Widuri *et al.,* 2019; Handoko & Thomas, 2021), there is no evidence of its potential moderating effect on the technological and organizational contexts in explaining the adoption process (Oliveira *et al.,* 2019). Given that companies operate within distinct environments and their actions are shaped by these external factors, it is reasonable to question whether the environmental context influences the other contexts of the TOE framework.

Auditing firms must comply with various standards issued by accounting regulatory and oversight bodies, such as those established by the Federal Accounting Council (CFC), the Securities and Exchange Commission (CVM), and the Central Bank of Brazil (Bacen). These standards have specific methodologies for their application, requiring professionals to possess high technical expertise. As a result, auditing firms operate in complex environments. They must adapt their physical and technological infrastructure, the profile of their professionals, and their knowledge of information technology and procedures to meet regulatory requirements. This necessity directly impacts their technological and organizational contexts.

In such an environment, isomorphic pressures are particularly relevant for audit firms, as these professionals adopt technologies while regulatory and professional bodies exert significant influence over their practices (Scott, 2003).

Companies can adapt their technological infrastructure and train their personnel to adopt emerging technologies in response to government regulations or customer requirements (coercive pressures), to align with competitors' practices (mimetic pressures), or to comply with regulatory bodies' directives (normative pressures).

The absorptive capacity of companies in adopting emerging technologies is influenced by government regulations, laws, and standards that require auditing firms to acquire specific knowledge to meet regulatory requirements (acquisition), by the imitation of practices adopted by other auditing firms (assimilation), by adherence to standards and norms established by regulatory bodies such as CFC and Ibracon (transformation), and by the exploration of emerging technologies to enhance efficiency and improve service quality (exploitation).

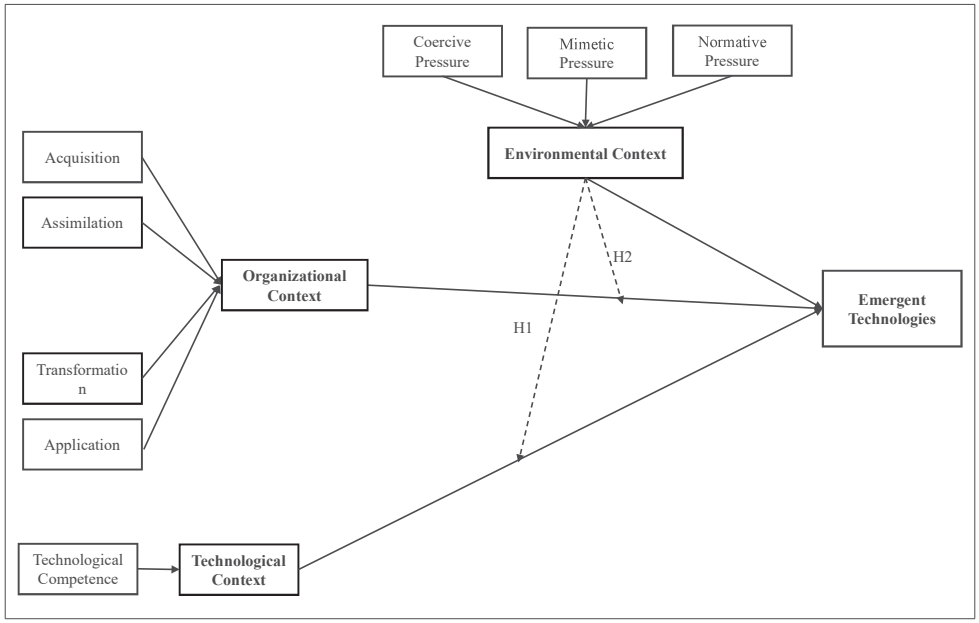
Thus, the influence of peers and companies in the same field and the impact of regulatory demands and normative bodies represent isomorphic pressures—mimetic, coercive, and normative—on audit firms. These pressures affect the adequacy of technological competence and the capacity to absorb knowledge for adopting emerging technologies (Villadsen *et al.,* 2010), suggesting that they can positively moderate the technological and organizational contexts.

Based on the previous discussion, the following research hypotheses are proposed:

H1 – The environmental context positively moderates the relationship between technological competence and the adoption of emerging technologies by audit firms.

H2 – The environmental context positively moderates the relationship between the environmental context and the adoption of emerging technologies by audit firms.

Figure 1 summarizes the study's theoretical model.



Source: developed by the authors (2023).

Figure 1. Theoretical Model

3 Method

The population of this study consists of auditing firms registered with the CVM, the regulatory and supervisory body of the National Financial System, which oversees the capital markets on an ongoing basis. A total of 322 firms, including Big Four and non-Big Four companies, are located across all regions of Brazil. A questionnaire was sent to the email addresses of professionals registered with the CVM and is available at <https://abre.ai/hSEN>.

Data were collected from June 10, 2022, to January 15, 2023. A total of 322 emails were sent to companies registered with the CVM, resulting in 121 responses. After excluding seven invalid responses, the final sample comprised 114 valid responses, yielding a response rate of 35.40%.

Tables 1 and 2 present the parameters and measurement methods for each variable used in the study, along with their operationalization and theoretical foundation.

Table 1

Research variables and measurement parameters

Variables		Description of the constructs (measurement parameters)	Theoretical foundation
Theoretical Context		My company's IT infrastructure is ready to adopt emerging technologies.	Chan & Chong (2013)
		My company is committed to ensuring its employees are familiar with emerging technologies.	
		My company is well-versed in emerging technologies.	
Environmental Context	Coercive Pressure	It is the intention of regulatory agencies that our company adopts emerging technologies.	
		Our company intends to adopt emerging audit technologies.	Liang *et al.* (2007)
		The competitive environment forces our company to adopt emerging audit technologies.	
	Normative Pressure	Our suppliers are increasingly adopting emerging technologies.	Liang *et al.* (2007)
		Our customers are increasingly adopting emerging technologies.	
		Regulators influence companies to adopt emerging technologies.	
	Mimetic pressure	Our competitors perceive the adoption of emerging audit technologies positively.	Liang *et al.* (2007)
		The adoption of emerging audit technologies has greatly benefited our company.	
		Our customers and suppliers perceive the adoption of emerging technologies in auditing positively.	

Variables	Description of the constructs (measurement parameters)	Theoretical foundation
Organizational Context	Searching for pertinent information about the adoption of emerging technologies is common in our company.	Flatten *et al.* (2011)
	Our management encourages employees to use other sources of information within the company when adopting emerging technologies.	
	Management expects employees to handle information on the adoption of emerging technologies beyond our area of expertise.	
	In our company, ideas and concepts about the adoption of emerging technologies are communicated across departments.	
	Our management emphasizes cross-departmental support to solve problems and concepts related to the adoption of emerging technologies.	
	In our company, there is a rapid flow of information. For example, if an important department obtains important information about the adoption of emerging technologies, it immediately communicates it to all other departments.	
	Our management periodically holds meetings with all departments to exchange new knowledge, problems, and achievements regarding the adoption of emerging technologies.	
	Our employees are encouraged to absorb new knowledge about the adoption and use of emerging technologies.	
	Our employees successfully link existing knowledge about the adoption of emerging technologies into new insights.	
	Our employees skillfully transform information from internal and external sources about the adoption of emerging technologies into valuable knowledge for our company.	
	Our management encourages employees to generate knowledge about the adoption of emerging technologies.	
	Our management supports the development of prototypes of emerging technologies.	
	Our company regularly reconsiders emerging technologies and adapts them according to new knowledge.	
	Our management supports the development of prototypes of emerging technologies.	
Adoption of emerging technologies	The audit firm you work for adopts artificial intelligence (AI).	Venkatesh & Bala (2012)
	The audit firm you work for adopts Robotic Process Automation (RPA).	
	The audit firm you work for adopts Blockchain.	
	The audit firm you work for adopts audit data analytics (ADA)	

Source: developed by the authors.

Table 2

Research variables, operationalization and theoretical frameworks

Variables	Operationalization	Theoretical foundation
Adoption of emerging technologies (AET)	Rated on a 7-point Likert scale, adapted by Venkatesh and Bala (2012)	Venkatesh & Bala (2012)
Technological context (TC)	Rated on a 7-point Likert scale, adapted by Chan and Chong (2013)	Chan & Chong (2013)
Environmental context (EC)	Coercive pressure (CP), normative pressure (NP), and mimetic pressure (MP), rated on a 7-point Likert scale, adapted by Liang et al. (2007)	Liang et al. (2007)
Organizational context (OC)	Acquisition (AQ), Assimilation (ASS), Transformation (TR) and Application (APP), rated on a 7-point Likert scale, adapted by Flatten et al. (2011)	Flatten et al. (2011)

Source: developed by the authors (2023).

The following statistical techniques were used to achieve the proposed objectives: descriptive statistics, ANOVA, Partial Least Squares Structural Equation Modeling (PLS-SEM), and moderation analysis using the product indicator method, as shown in Table 3.

Table 3
Objectives and tests

Objectives	Tests
To present the profile of auditing companies.	Descriptive statistics
Analyze the direct relationship between technological, organizational and environmental contexts in the adoption of emerging technologies.	Structural equation modeling
Compare the level of adoption of emerging technologies by type of audit firm.	ANOVA
Analyze the moderating role of the environmental context in the relationship between technological and organizational contexts and the adoption of emerging technologies.	Product indicator

Source: developed by the authors.

Note that Structural Equation Modeling (SEM) using the Partial Least Squares approach (PLS-SEM) was adopted to examine the associative relationship between the constructs, employing a one-dimensional model suitable for samples with fewer than 200 participants (Hair *et al.*, 2014).

The product indicator method, which calculates the sum of the products between each indicator (scale item) of the independent variable and all indicators of the moderating variable, was used to analyze the moderating role of EC in the relationship between audit firms' TC and OC and AET (Kenny & Judd, 1984).

Moderating effects occur when a moderating variable influences the strength or direction of the direct relationship between independent and dependent variables (Henseler & Fassott, 2010). A moderating variable modifies this relationship; many such variables are discrete or nominal (Baron & Kenny, 1986). Analyzing moderating effects can provide a deeper understanding of the relationships among the studied variables.

Studies using moderating variables examine how the structural model adjusts across different pre-established groups and assess differences in regression coefficients based on the value of the moderator (Sharma *et al.*, 1981). Moderation using the product indicator method has been recommended in more recent studies employing Structural Equation Modeling under the Partial Least Squares approach (PLS-SEM).

4 Results

The survey included auditing companies from all Brazilian regions, emphasizing the Southeast with 56%, followed by the South with 21% of responses, and the Northeast with 18% of responses. A similar result was found by Amorim *et al.* (2012), who also included auditing companies from all Brazilian regions and highlighted the presence of the Southeast.

Regarding the type of audit firm, the results indicate that 96% of the sample consists of non-Big Four companies, with 11% representing medium-sized firms such as BDO, Grant Thornton, Nexia International, and Baker Tilly, and 85% comprising small firms. These findings highlight a concentration of survey participants in small and medium-sized companies.

Table 4 presents the descriptive statistics (mean, minimum, maximum, and standard deviation) for the environmental, technological, and organizational contexts of the TOE framework and the adoption of emerging technologies.

Table 4
Sample's descriptive analysis

Contexts	Description	N	Minimum	Maximum	Mean	Standard Deviation
CT	Total	114	2,67	7,00	5,78	1,00
CA	Pressão Coercitiva	114	3,67	7,00	6,23	0,73
	Pressão Normativa	114	3,00	7,00	5,42	1,08
	Pressão Mimética	114	3,00	7,00	5,70	1,12
	Total	114	3,22	7,00	5,78	0,73
CO	Total	114	3,61	7,00	5,31	0,91
ATE	Total	114	1,00	7,00	3,99	1,98

Source: developed by authors.

Regarding the TC result, audit firms exhibited an average of 5.78, indicating high technological competence. This finding aligns with Rosli *et al.* (2016), who observed that companies had an adequate IT infrastructure and employees with the technical competence to adopt technologies. The high standard deviation in TC suggests significant variability among the types of audit firms participating in this study.

In general, the EC result showed that auditing companies presented an average of 5.78, which indicates that the companies in this study understand that the environment in which auditing companies operate is influenced by sector characteristics, standards, competitive pressure, etc.

Further analysis reveals that coercive pressure obtained the highest average (6.23), which shows that audit firms suffer specific formal or informal pressures from other institutional entities, such as the government and regulatory bodies (Liang *et al.*, 2007; Teo *et al.*, 2003). Next comes mimetic pressure, with an average of 5.79, which indicates that audit firms are influenced by competitors and describes imitative behavior by companies in relation to similar organizations (Glover *et al.*, 2014; Teo *et al.*, 2003). Finally, normative pressure obtained an average of 5.42, thus showing that audit firms suffer pressure from professional bodies that establish quality standards for specific organizational processes associated with professionalization (Coraiola & Machado-da-Silva, 2007). Note that regulatory pressure obtained the lowest average, explained by the absence of regulations for using emerging technologies. This result is consistent with the findings of Rosli *et al.* (2013), who identified that regulatory pressure has a moderate effect on the use of audit technologies since the lack of guidance in regulations and professional standards can inhibit auditors from fully adopting technological advances (Salijene *et al.*, 2018). Regulatory and standard-setting bodies may be slow to make the necessary adjustments to keep up with technological advances (Kend & Nguyen, 2020).

The OC results indicate that auditing firms achieved an average of 5.31, reflecting a high level of absorptive capacity. This finding aligns with Youssef *et al.* (2015), who argue that technological absorptive capacity is linked to a company's technological readiness, meaning that firms must have adequate technological infrastructure and qualified personnel.

Finally, the audit firms presented an average of 3.99 for the AET, demonstrating an average level of adoption of emerging technologies. Attention is drawn to the high level of standard deviation (1.98) of this construct, which must be influenced by the variability in size of the audit firms.

4.1 Validation of the measurement model

Next, reliability analyses were conducted using Cronbach's alpha and composite reliability (CR). At the same time, convergent validity was assessed through the Average Variance Extracted (AVE), and discriminant validity was evaluated using the Fornell-Larcker criterion to ensure the robustness of the measurement model.

The constructs were validated using Confirmatory Factor Analysis (CFA) to refine the scales. Following the guidelines of Hair *et al.* (2014), 28 indicators exhibited factor loadings greater than 0.7, with statistical significance and individual reliability above 0.50. Two indicators, Organizational Context – Assimilation (ASS4) and Organizational Context – Transformation (TR), had factor loadings below 0.4 and no statistical significance, leading to their removal from the model.

Composite reliability, Cronbach's alpha, and AVE were recalculated to assess the effects of excluding the indicators, as shown in Table 5.

Table 5

Composite Reliability, Cronbach's Alpha, and AVE

Contexts	Description	N	Cronbach's alpha	Composite Reliability	AVE
Contexto Tecnológico (CT)		3	0,932	0,914	0,78
Contexto Ambiental (CA)	Coercive pressure (CP)	3	0,776	0,841	0,67
	Normative pressure (NP)	3	0,803	0,847	0,67
	Mimetic pressure (MP)	3	0,711	0,768	0,55
Contexto Organizacional (CO)	Acquisition (AQ)	3	0,827	0,806	0,59
	Assimilation (ASS)	4	0,785	0,797	0,68
	Transformation (TR)	4	0,844	0,836	0,7
	Application (APP)	3	0,966	0,969	0,91
Adoção de tecnologias emergentes (ATE)		4	0,897	0,908	0,71

(**) Significant at 5%

Source: developed by the authors (2023).

Next, discriminant validity was assessed by analyzing cross-loadings using the Fornell-Larcker criterion (1981). The results indicate that the square roots of the AVEs were greater than the correlations between the constructs, confirming the presence of discriminant validity (Table 6).

Table 6
Discriminant validity – Fornell-Larcker (1981)

Description	TC	NP	CP	MP	AQ	ASS	TR	APP	AET
TC	0.942								
NP	0.464	0.894							
CP	0.151	0.388	0.876						
MP	0.601	0.334	0.152	0.862					
AQ	0.628	0.653	0.342	0.416	0.736				
ASS	0.094	0.194	0.189	0.201	0.201	0.867			
TR	0.235	0.168	0.145	0.247	0.063	0.438	0.729		
APP	0.538	0.331	0.091	0.593	0.457	0.091	0.363	0.966	
AET	0.403	0.486	0.247	0.283	0.626	0.499	0.204	0.476	0.873

Source: developed by the authors (2023).

4.1 Assessment of the structural model's validity

The VIF (Variance Inflation Factor) values for the dimensions ranged from 1.229 to 3.367, remaining below the critical threshold, indicating no collinearity issues in the model.

The positive Stone-Geisser Q^2 result also confirms the model's predictive capacity (Hair *et al.*, 2014). The blindfolding procedure yielded positive values, supporting the model's predictive relevance.

Next, the significance and relevance of the relationships were assessed to test the theoretical framework. Following Hair *et al.* (2014), the bootstrapping procedure with 5,000 subsamples was employed to verify the significance of the proposed structural paths. Table 7 presents a summary of the results.

Table 7
Results of the structure equations modeling

Structural Model – path analysis	Structural Coefficient	Erro-padrão	T	p-value	R2	f2
TC > AET	0.673	0,141	4,758	0,000*		0,511
EC > AET	0.341	0,076	6,648	0,019**	0,645	0,158
OC > AET	0.787	0,314	6,830	0,000*		0,783

(*) Significant at 1%, (**) Significant at 5%.

Fonte: elaborado pelos autores (2023).

The model implemented in this study showed a high R^2 effect, exceeding 0.50 (Table 4). Regarding the effect size (f^2) evaluation, the results indicate a high effect for TC and OC and a moderate effect for EC. These findings suggest that OC and TC have strong predictive power regarding the adoption of emerging technologies.

The findings confirm the theoretical foundation of this study—the TOE framework—demonstrating that a company's TC, OC, and EC influence audit firms' decisions regarding the adoption of emerging technologies (Tornatzky & Fleischer, 1990).

Overall, the findings indicate that TC is the most influential construct in audit firms' adoption of emerging technologies, followed by OC and EC.

An individual analysis of the contexts indicates that technological competence positively and significantly influences audit firms' adoption of emerging technologies (β = 0.673, p = 0.000). Authors such as Cruz-Jesus *et al.* (2019) highlight the importance of the technological context in this process.

This influence is explained by the fact that, without compatible equipment, direct access to intranet and extranet, and adequately trained auditors to perform audit procedures, the adoption of blockchain, AI, ADA, and RPA would be significantly hindered.

Auditors must adapt their technological infrastructure to meet the needs and requirements of their clients, ensuring efficient and effective audit procedures and maintaining the integrity of clients' internal control systems. Small audit firms, which typically serve less sophisticated clients, tend to make smaller investments in infrastructure and staff training but still recognize the importance and necessity of these strategies (Widuri *et al.*, 2019). In contrast, large audit firms (Big Four), which generally serve larger and more complex clients with sophisticated IT systems, make substantial investments in equipment, recruitment, and staff training to remain compatible with their clients' technological environments. (Widuri *et al.*, 2019).

This result aligns with the findings of Handoko and Thomas (2021), Widuri *et al.* (2019), and Rosli *et al.* (2016), who examined the adoption of audit technologies by audit firms and identified the need of investment, as well as the structural differences between small, medium, and large audit firms.

Furthermore, the results indicate that EC positively and significantly influences the adoption of emerging technologies by audit firms (β = 0.341, p = 0.019).

This result shows that the EC – presented as the environment in which a organization conducts its business, such as industry segment, competitors, suppliers, and government, regulatory, and normative bodies (Oliveira, 2017), and in this study measured through Institutional Theory – has a direct effect on the adoption of emerging technologies. Therefore, factors such as government, competition among audit firms, country regulation, and technological advancement influence audit firms in the adoption of new technologies (Dagiliene & Kloviené, 2019).

Several emerging technologies offer opportunities to enhance audit efficiency and effectiveness, such as RPA (Moffitt *et al.*, 2018) and drones (Christ *et al.*, 2020). These competitive advantages can enable auditors, particularly those in small and medium-sized firms, to adopt successful practices already implemented by large audit firms (Big Four).

This finding supports Handoko (2021), Siew *et al.* (2019), Widuri *et al.* (2019), and Rosli *et al.* (2016), who identified opportunities to enhance efficiency through the adoption of new technologies.

Regarding the last context, the results show that OC positively and significantly influences audit firms' adoption of emerging technologies (β=0.787, p=0.000).

This finding indicates that OC, which encompasses organizational characteristics such as IT trust and know-how, organizational size, centralization, formalization, management structure complexity, quality of human resources, and internally available resources (Tornatzky & Fleischer, 1990), influences the adoption of emerging technologies within audit firms. In this study, OC was measured through absorptive capacity.

Applying new technologies in audit procedures has been essential for scaling operations and increasing effectiveness in the accounting audit sector. Since absorptive capacity is a dynamic, knowledge-based resource (Ali & Park, 2016), audit firms have adapted to the rapid need for technological advancements and internal process adjustments.

Although audit firms are at different stages of implementing emerging technologies (Barr-Pulliam et al., 2022), there is a strong relationship between knowledge acquisition and assimilation and the adoption of emerging technologies across audit firms. However, the transformation and application of this knowledge have been more prevalent in large and medium-sized audit firms.

This result aligns with the findings of Handoko (2021) and Widuri *et al.* (2019), who identified varying levels of technology adoption, such as machine learning and General Audit Software (GAS), primarily influenced by the size of the audit firm.

Next, the product indicator method was applied to address this study's general objective of analyzing the moderation effect of EC on the relationships between TC, OC, and the adoption of emerging technologies. Additionally, moderation was examined by segregating EC into coercive, mimetic, and normative pressures to capture the distinct effects of these forces.

Table 8
Moderation Results

Structural models – path analysis	Structural Coefficient	Standard Error	T	p-value
CO x CA > ATE	0,084	0,084	1,004	0,315
CT x CA > ATE	0,011	0,092	0,116	0,907
CO x PC > ATE	0,012	0,126	0,098	0,922
CT x PC > ATE	0,009	0,145	0,063	0,950
CO x PM > ATE	0,173	0,195	0,889	0,374
CT x PM > ATE	0,161	0,204	0,790	0,430
CO x PN > ATE	0,486	0,044	11,04	0,000*
CT x PN > ATE	0,337	0,063	6,241	0,000*

(*) Significant at 1%, (**) Significant at 5%.

Source: developed by the authors (2023)..

The findings indicate that EC does not moderate the relationship between OC and the adoption of emerging technologies. This result provides evidence that rejects hypothesis H1, aligning with the findings of Oliveira *et al.* (2019), who concluded that EC does not moderate the relationship between OC and the adoption of software as a service.

Additionally, the results indicate that EC does not moderate the relationship between TC and the adoption of emerging technologies, providing evidence that rejects hypothesis H2. This result is at odds with the work of Oliveira *et al.* (2019), who indicated that EC positively moderates the relationship between TC and the adoption of software as a service.

The lack of regulatory guidance causes audit firms to hesitate in adopting emerging technologies. A study by Eilifsen *et al.* (2020) involving audit firm partners in Norway found that regulatory bodies intended to inspect completed audits where technologies such as blockchain and AI had been used before determining whether the technology was appropriate. This indicates that no standardized procedures exist for validating work performed with emerging technologies in accordance with auditing standards.

Furthermore, as highlighted by Barr-Pulliam et al. (2022), the adoption of emerging technologies in the current environment in which audit firms operate is more closely linked to the financial capacity of firms than to regulatory requirements.

Additionally, the moderating role of EC was analyzed by segregating it into coercive, mimetic, and normative pressures. The results indicated that coercive pressure does not moderate the relationship between TC, EC, or the adoption of emerging technologies. On the other hand, normative pressure positively moderates the relationship between TC, EC, and the adoption of emerging technologies.

The CVM primarily exerts coercive pressure on auditing, while the CFC and Ibracon impose normative pressures.

Accounting standards began to be issued by the Accounting Pronouncements Committee (CPC) and approved by the CFC following the implementation of Law No. 11,638 of 2007. Regarding auditing standards, the CFC is responsible for issuing all NBCs PA (Brazilian Accounting Standards – Independent Auditor), which establish rules for professional practice, and NBCs TA (Brazilian Accounting Standards – Independent Audit of Historical Accounting Information), which define doctrinal concepts, rules, and procedures applicable to auditing.

Therefore, the CVM is responsible for overseeing the application of accounting standards. It assesses whether auditing complies with these standards within the capital market but does not issue the standards. Thus, this distinction may have influenced the research results.

Finally, the results indicated that mimetic pressures do not moderate the relationship between TC and EC and the adoption of emerging technologies.

Handoko (2021) and Siew *et al.* (2019) note that audit firms' use of technologies can provide a competitive advantage. However, large companies and, to some extent, medium-sized audit firms have the infrastructure to develop customized tools. In contrast, small firms typically purchase ready-made tools that they adapt to their needs. Thus, these factors may limit an audit firm's ability to replicate the technologies used by competing firms.

Conclusion

This study aimed to analyze the moderating role of the environmental context in the relationship between the technological and organizational contexts and the adoption of emerging technologies by audit firms in a regulated environment. To achieve this objective, a descriptive study was conducted using a quantitative survey. The population consisted of audit firms registered with the CVM, resulting in a final sample of 114 valid responses. The statistical analyses included descriptive statistics, Partial Least Squares Structural Equation Modeling (PLS-SEM), and moderation analysis using the product indicator method.

The findings confirm the theoretical foundation of this study, the TOE framework, within the scope of auditing. The results indicate that a company's technological, organizational, and environmental contexts influence decisions regarding audit firms' adoption of emerging technologies, with a greater influence observed from the technological and organizational contexts.

The organizational context emerged as the most influential construct in audit firms' adoption of emerging technologies. This demonstrates that absorptive capacity—encompassing the acquisition and assimilation of knowledge about emerging technologies, followed by their transformation and application—is a key factor in the adoption of blockchain, AI, ADA, and RPA in auditing.

The results also indicate that the technological context is the second most influential factor in the adoption of emerging technologies. These findings suggest that technological infrastructure (equipment and software) and the competence of IT personnel are critical aspects for effectively utilizing emerging technologies.

The environmental context had the smallest effect on the adoption of emerging technologies, indicating that while coercive, normative, and mimetic pressures influence adoption, they are not the determining factors in this process.

Regarding the moderating role of the environmental context, the results indicate that normative pressure positively moderates the relationship between technological context, organizational context, and adoption of new technologies, partially confirming this study's hypotheses.

This study measured the environmental context through coercive, normative, and mimetic pressures. Additionally, the CVM was considered the regulatory body for audit firms, as it oversees compliance with accounting standards and verifies whether audits are conducted by the standards issued by the CFC, the professional body for accountants, which may have influenced the results.

Regarding mimetic pressure, competition between auditing firms, high investments by large auditing firms (the big four), and the existence of tools that can be customized by small auditing firms may indicate that auditing firm copy the technologies used by competing companies.

In summary, this study proposed that the environmental context of the TOE framework positively moderates the relationship between the technological and organizational contexts in audit firms' adoption of emerging technologies. Hence, the results indicate that this study's hypotheses are partially supported, as only normative pressure moderates the relationship between the technological and organizational contexts in the adoption of emerging technologies.

This study's contribution lies in the empirical validation of the TOE framework's predictive power in audit firms' adoption of emerging technologies, demonstrating that the technological, organizational, and environmental contexts are important predictive factors in this process.

Furthermore, this study contributes to the theoretical field, mainly accounting knowledge and auditing. It advances and deepens the discussion on the factors influencing audit firms' adoption of emerging technologies by (i) incorporating the environmental context as a moderating variable in the TOE framework of technological and organizational contexts, (ii) using absorptive capacity as a novel approach to measuring the organizational context; and (iii) applying Institutional Theory (coercive, normative, and mimetic pressures) as a new way of measuring the environmental context, particularly in regulated environments. These contributions help advance the literature on the adoption of emerging technologies.

Limitations were identified in the development of this study. First, despite the statistical rigor in the analyses, the results rely on self-reported data, which may lead to inaccuracies, as participants might withhold behaviors not explicitly covered by standards and regulations. Second, the responses suggest that some participants provided answers with limited detail or lacked careful attention when completing the questionnaire.

Future research could compare the adoption of emerging technologies across different countries to identify potential cultural similarities and differences. Regarding variables, other factors could be explored, such as applying the Diffusion of Innovation Theory as a construct for the technological context. Finally, a qualitative approach is recommended for a more in-depth analysis of the issues examined.

References

AICPA. Reimagining Auditing in Wire Word. AICPA, 2014. Disponível em: https://us.aicpa.org/content/dam/aicpa/interestareas/frc/assuranceadvisoryservices/downloadabledocuments/whitepaper_blue_sky_scenario-pinkbook.pdf. Acesso em: 10 abr. 2022.

Al-Htaybat, K. & Von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, Auditing & Accountability Journal, 30*(4), 850-873. https://doi.org/10.1108/AAAJ-07-2015-2139.

Ali, M. & Park, K. (2016). The mediating role of an innovative culture in the relationship between absorptive capacity and technical and non-technical innovation. *Journal of Business Research, 69*(5), 1669-1675. https://doi.org/10.1016/j.jbusres.2015.10.036.

Amorim, E. N. C.; Vicente. E. F. R.; Will, A. R. & Silva, F. A. (2012). O mercado de auditoria no Brasil: um retrato considerando a percepção das firmas de auditoria. *Revista Catarinense da Ciência Contábil – CRCSC, 11*(32). http://dx.doi.org/10.16930/2237-7662/rccc.v11n32p73-87.

Appelbaum, D. & Nehmer, R. A. (2017). Using drones in internal and external audits: An exploratory framework. *Journal of Emerging Technologies in Accounting, 1,* 99-113. http://10.2308/jeta-51704.

Arpaci, I.; Yardimci, Y. C.; Ozkan, S. & Turetken, O. (2012). Organizational, adoption of information technologies: a literature review. *International Journal of eBusiness and eGovernment Studies.* 4 (2), 37-50

Austin, A.; Carpenter, T; Christ, M & Nielson, C. (2019). The data analytics transformation: Evidence from auditors, CFOs, and standard-setters. *SSRN.* http://10.2139/ssrn.3214140.

Baker, J. (2012). The technology-Organization-Environment Framework. *In:* Y.K. Dwivedi *et al.* (Eds.). Information Systems Theory: Explaining and Predicting Our Digital Society, *Integrated Series in Information Systems, 1*(28). https://doi.org/10.1007/978-1-4419-6108-2_1

Baron, R. M. & Kenny, D. A. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182. DOI: 10.1037//0022-3514.51.6.1173

Barr-Pulliam, D.; Brown-Liburd, H. L. & Munoko, I. (2022). The Effects of Person-Specific, Task, and Environmental Factors on Digital Transformation and Innovation in Auditing: A Review of the Literature. *Journal of International Financial Management & Accounting, 33* (2), 337-374. https://doi.org/10.1111/jifm.12148

Barr-Pulliam, D.; Brown-Liburd, H. L. & Sanderson, K. A. (2021). The effects of the internal control opinion and use of audit data analytics on perceptions of audit quality, assurance, and auditor negligence. *Auditing: A Journal of Practice and Theory,* 41 (1): 25–48. https://doi.org/10.2308/AJPT-19-064.

Bradley, S. W.; Shepherd, D. A. & Wiklund, J. (2011). The importance of slack for new organizations facing 'tough' environments. *Journal of Management Studies, 48*(5), 1071–1097. https://doi.org/10.1111/j.1467-6486.2009.00906.x

Brown-Liburd, H. & Vasarhelyi, M. (2015). Big Data and Audit Evidence. *Journal of Emerging Technologies in Accounting, 12*(1), 1–16. https://10.2308/jeta-10468.

Cao, S.; Cong, L. W. & Yang, B. (2015) Financial reporting and blockchains: Audit pricing, mis- statements, and regulation. SSRN Electronic Journal https://ssrn.com/abstract=3373379. http://dx.doi.org/10.2139/ssrn.3248002

Carpenter, V. L. & Feroz, E. H. (2001). Institutional theory and accounting rule choice: An analysis of four US state governments' decisions to adopt generally accepted accounting principles. *Acc. Organ. Soc., 26*(7), 565–596. https://doi.org/10.1016/S0361-3682(00)00038-6.

Chan, F. T. & Chong, A. Y. L. (2013). Determinants of mobile supply chain management system diffusion: a structural equation analysis of manufacturing firms. *International Journal of Production Research, 51*(4), 1196-1213. https://doi.org/10.1080/00207543.2012.693961.

Cohen, W. & Levinthal, D. (1990). Absorptive capacity, a new perspective on learning and innovation, Admin. *Sci. Quart, 35*(1), 128–152. https://doi.org/10.2307/2393553.

Cooper, L. A.; Holderness, D. K.; Sorensen, T. L. & Wood, D. A. (2019). Robotic Process Automation in Public Accounting. *Accounting Horizons, 33*(4), 15-35. http://dx.doi.org/10.2139/ssrn.3193222.

Coraiola, D. M; Machado-da-Silva, C. L. (2008). A influência dos discursos no isomorfismo organizacional: as mudanças gráficas em jornais brasileiros. *Revista Eletrônica de Ciência Administrativa*. 7(2), 1-13

Cruz-Jesus, F., Pinheiro, A. & Oliveira, T. (2019) Understanding CRM adoption stages: Empirical analysis building on the TOE framework. *Computers in Industry* 109: 1–13. https://doi.org/10.1016/j.compind.2019.03.007

Cui, L., & Jiang, F. (2012). State ownership effect on firms' FDI ownership decisions under institutional pressure: a study of Chinese outward-investing firms. Journal of International Business Studies, 43(3), 264-284. Doi:10.1057/jibs.2012.1

Dagiliene, L. & Klovienė, L. (2019). Motivation to use big data and big data analytics in external auditing. *Managerial Auditing Journal, 34*(7), 750–782. https://doi.org/10.1108/MAJ-01-2018-1773.

Dedoulis, E. (2016). Institutional formations and the Anglo-Americanization of local auditing practices: The case of Greece. *Accounting Forum, 40*(1), 29–44. https://doi.org/10.1016/j.accfor.2015.11.003.

DePietro, R., Wiarda, E., & Fleischer, M. (1990). The context for change: Organization, technology and environment. In L. G. Tornatzky & M. Fleischer (Eds.), The processes of technological innovation (pp. 151-175). Lexington, MA: Lexington Books.

Dimaggio, P. J. & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review,48(*2), 147–160. https://doi.org/10.2307/2095101.

Ding, K.; Peng, X.; Lev, B.; Sun, T. & Vasarhelyi, M. A. (2020). Machine Learning Improves accounting estimates: evidence from insurance payments. Review of Accounting Studies 25, 1098-1123. https://doi.org/10.1007/s11142-020-09546-9

Eilifsen, A.; Kinserdal, F; Messier Jr & Mckee, T. E. (2020). An exploratory study into the use of audit data analytics on audit engagements. *Accounting Horizons.34*(4). http://10.2308/HORIZONS-19-121.

Flatten, T. C.; Engelen, A.; Zahra, S. A. & Brettel, M. (2011). A measure of absorptive capacity: Scale development and validation. *European Management Journal, 29*(2), 98-116. https://doi.org/10.1016/j.emj.2010.11.002.

Fornell, C. & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error: algebra and statistics. *Journal of Marketing, 18*(1), 39-59. https://doi.org/10.2307/3151312

Freitas, C. A. S. & Guimarães, T. A. (2007). Isomorphism, Institutionalization and Legitimacy: Operational Auditing at the Court of Auditors. *RAC*, 153 - 175. https://doi.org/10.1590/S1415-65552007000500008.

Glover, J. L.; Champion, D.; Daniels, K. J. & Dainty, A. J. D. (2014). An Institutional Theory perspective on sustainable practices across the dairy supply chain. *International Journal of Production Economics*, 152, 102-111. https://doi.org/10.1016/j.ijpe.2013.12.027

Grover, V. & Kohli, R. (2012). Cocreating IT value: New capabilities and metrics for multifirm environments. *Mis Quarterly, 36*(1). https://doi.org/10.2307/41410415.

Hair, J. F. J.; Ringle, C. M. & Sarstedt, M. (2014). *Partial least squares structural equation modeling*: Rigorous applications, better results and higher acceptance. Long Range Planning: *International Journal of Strategic Management,46*(1-2), 1–12. http://dx.doi.org/10.1016/j.lrp.2013.01.001.

Handoko, B. L. (2021). How audit firm size moderate effect of TOE context toward auditor adoption of machine learning. *Journal of Theoretical and Applied Information Technology, 99*(24), 5972-5980.

Handoko, B. L. & Thomas, G. N. (2021). How audit firm size moderate effect of TOE context toward auditor adoption of technology. *Turkish Journal of Computer and Mathematics Education. 12*(6), 1518-1526.

Henry, B. & Hicks, M. (2015). A Survey of Perspectives on the Future of the Accounting Profession. *The CPA Journal*, 85(8), 6-9.

Hinings, B.; Gegenhuber, T. &Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization, 28*(1), 52–61. https://doi.org/10.1016/j.infoandorg.2018.02.004.

Henseler, J. & Fassott, G. (2010). Testing Moderating Effects in PLS Path Models: An Illustration of Available Procedures. *Handbook of Partial Least Squares*, 713-735.

Huang, F. & Vasarhelyi, M. A. (2019). Applying robotic process automation (HUU) in auditing: A framework. *International Journal of Accounting Information Systems, 35*, 1-11. https://doi.org/10.1016/j.accinf.2019.100433.

Inghirami, I. E. (2018). *Accounting Information Systems in the Time of Blockchain.* Pávia: ITAIS Conference.

Kroon, N.; Alves, M. C. & Martins, I. (2021). The Impacts of Emerging Technologies on Accountants' Role and Skills: Connecting to Open Innovation—A Systematic Literature Review. *Journal of Open Innovation: Technology, Market, and Complexity,* 7(3), 2021. https://doi.org/10.3390/joitmc7030163.

Kend, M. & Nguyen, L. (2010). Big Data Analytics and Other Emerging Technologies: The Impact on the Australian Audit and Assurance Profession. *Australian Accounting Review*, 90, 1–14. https://doi.org/10.1111/auar.12305

Kenny, D. A. & Judd, C. M. (1984). Estimating the nonlinear and interactive effects of latent variables. *Psychological Bulletin*, 96 (1), 201–210. https://doi.org/10.1037/0033-2909.96.1.201

Li, Q. & Vasarhelyi, M. (2018). Developing a Cognitive Assistant for the Audit Plan Brainstorming Session. *The International Journal of Digital Accounting Research, 18*, 119–140. https://doi.org/10.4192/1577-8517-v18_5.

Liang, H.; Saraf, N.; Hu, Q. & Xue, Y. (2007). Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management. *Mis Quarterly, 31*(1), 59-87. https://doi.org/10.2307/25148781.

Low, C.; Chen, Y. & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial management & data systems, 111* (7), 1006-1023. https://doi.org/10.1108/02635571111161262.

Majchrzak, A.; Markus, M. L. & Wareham, J. (2016). Designing for digital transformation: Lessons for information systems research from the study of ICT and societal challenges. *MIS Quarterly, 40*(2), 267-277. https://doi.org/10.25300/MISQ/2016/40:2.03

Mckinley, W. & Mone, M. (2003). Organization theory. Oxford University Press – USA.

Moffitt, K. C.; Rozario, A. M.; Vasarhelyi, M. A. (2018). Robotic process automation for auditing. *Journal of Emerging Technologies in Accounting*, 15(1), 1–10. DOI: 10.2308/jeta-10589

Montes, G. A. & Goertzel, B. (2019). Distributed, decentralized, and democratized artificial intelligence. *Technological Forecasting and Social Change,141*, 354-358. https://doi.org/10.1016/j.techfore.2018.11.010.

Oliveira, R. C. R. (2017). Adoção de tecnologias da informação em micro, pequenas e médias empresas**:** um estudo a partir da adaptação do modelo Technology, Organization and Environment (TOE) sob influência de fatores institucionais (Tese de Doutorado, Universidade Federal da Bahia). https://repositorio.ufba.br/handle/ri/24535

Oliveira, T. & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *The Electronic Journal Information Systems Evaluation,* 14 (1), 110-121.

Oliveira, T.; Martins, R.; Sarker, S.; Thomas, M. & Popovič, A. (2019). Understanding SaaS adoption: The moderating impact of the environment context. *International Journal of Information Management*, *49*, 1-12. https://doi.org/10.1016/j.ijinfomgt.2019.02.009.

Park, J. H.; Suh, H. J. & Yang, H. D. (2007). Perceived absorptive capacity of individual users in performance of enterprise resource planning (ERP) usage: the case of Korean firms. *Inform. & Manage*, 44(3), 300–312.DOI:10.1016/j.im.2007.02.001

Pimentel, E. & Boulianne, E. (2020). Blockchain in Accounting Research and Practice: Current Trends and Future. Opportunities. *Accounting Perspectives, 19*(4), 325–361. https://doi.org/10.1108/AAAJ-10-2020-4991.

Pivar, J. (2021) Adoption of big data technologies in smart cities of the European Union: Analysis of the importance and performance of technological factors. *Croatian Regional Development Journal.* 2(1), 11-29. DOI:10.2478/crdj-2021-0005

Rosli, K.; Siew, E.G & Yeow, P. H. P. (2016). Technological, Organizational and Environmental Aspects of Audit Technology Acceptance. *International Journal of Business and Management*, 11(5), 140-145 Doi: 10.5539/ijbm.v11n5p140

Rosli, K.; Yeow, P. & Siew, E-G. (2013). Adoption of Audit Technology in Audit Firms" (2013). *ACIS 2013 Proceedings*. 43. https://aisel.aisnet.org/acis2013/43

Rozario, A. M. & Vasarhelyi, M. A. (2019a). Auditing with smart contracts. *International Journal of Digital Accounting Research, 18*(1), 1–27. https://doi.org/10.4192/1577-8517-v18_1.

Rozario, A. M. & Vasarhelyi, M. A. (2019b). How robotic process automation is transforming accounting and auditing**.** *The CPA Journal, 88*, 46–49. https://doi.org/10.20869/AUDITF/2020/160/024.

Salijeni, G.; Samsonova-Taddei, A. & Turley, S. (2019). Big Data and Changes in Audit Technology: Contemplating a Research Agenda. *Accounting and Business Research, 49*(1), 95–119. https://doi.org/10.1080/00014788.2018.1459458.

Sancho-Zamora, R.; Hernández-Perlines, F.; Peña-García, I. & Gutiérrez-Broncano, S. (2022). The Impact of Absorptive Capacity on Innovation: The Mediating Role of Organizational Learning. *International Journal of Environment Research and Public Health, 19*(2), 842. https://doi.org/10.3390/ijerph19020842.

Santos, F.; Pereira, R. & Vasconcelos, J. B. (2020). Toward robotic process automation implementation: an end-to-end perspective. *Business Process Management Journal, 26***(2)**, 405-420**.** https://doi.org/10.1108/BPMJ-12-2018-0380

Scott, W. (2003). Organisation: Rational, Natural, and Open System. 5. ed. Upper Saddle River, NJ: Prentice Hall.

Sharma, S.; Durand, R.M. & Gur-Arie, O. (1981). Identification and Analysis of Moderator Variables. *Journal of Marketing Research***,** 18, 291-300. https://doi.org/10.2307/3150970

Siew, E.G., Rosli, K. & Yeow, P.H.P. (2019). Organizational and environmental influences in the adoption of computer-assisted audit tools and tec**.** *International Journal of Accounting Information Systems, 36,* 100445. https://doi.org/10.1016/j.accinf.2019.100445.

Sun, T. (2019). Applying Deep Learning to Audit Procedures: An Illustrative Framework. *Accounting Horizons,* 33 (3), p.89-109. https://doi.org/10.2308/acch-52455

Sun, T. & Sales, L. J. (2018). Predicting Public Procurement Irregularity: An Application of Neural Networks. *Journal of Emerging Technologies in Accounting, 15*(1), 141–154. https://doi.org/10.2308/jeta-52086.

Tajudeen, F. P.; Jaafar, N. I. & Ainin, S. (2017). Understanding the Impact of Social Media Usage among Organizations. *Information & Management*. 55(2018), 308-321. https://doi.org/10.1016/j.im.2017.08.004

Teo, H. H.; Wei, K. K. & Benbasat, I. (2003). Predicting Intention to Adopt Interorganizational Linkages: An Institutional Perspective. *Mis Quarterly*, 27 (1), 19-49. https://doi.org/10.2307/30036518

Tornatzky, L. G. & Fleischer, M. (1990). *The Processes of Technological Innovation.* Lexington – MA: Lexington Books.

Tsou, H.-T. & Hsu, S. H.-Y. (2015). Performance effects of technology–organization–environment openness, service co-production, and digital-resource readiness: The case of the IT industry. *International Journal of Information Management, 35*(1), 1-14. https://doi.org/10.1016/j.ijinfomgt.2014.09.001.

Tu, Q.; Vonderembse, M. A.; Ragu-Nathan, T. S. & Sharkey, T. W. (2006). Absorptive capacity: enhancing the assimilation of time-based manufacturing practices. *Journal of Operations Management.* 24 (5), 692–710. DOI:10.1016/j.jom.2005.05.004

Vasarhelyi, M. A., Kogan, A., & Tuttle, B. M. (2015). Big data in accounting: An overview. *Accounting Horizons, 29*(2), 381-396. https://doi.org/10.2308/acch-51071

Venkatesh, V. & Bala, H. (2012). Adoption and impacts of interorganizational business process standards: Role of partnering synergy**.** *Information Systems Research, 23*(4),1-27. https://doi.org/10.1287/isre.1110.0404.

Villadsen, A. R.; Hansen, J. R. & Mols, N. P. (2010). When do public managers imitate each other? Mimetic decision making in contracting decisions of Danish municipalities. *Public Organization Review, 10*(4), 357–376. https://doi.org/10.1007/s11115-010-0111-x

Warren, J. D.; Moffitt, K. C. & Byrnes, P. (2015). How big data will change accounting. *Accounting Horizons, 29*(2), 397–407. https://doi.org/10.2308/acch-51069.

White, B. S.; King, C. G. & Hollada, J. (2020). Blockchain security risk assessment and the auditor. *Journal of Corporate Accounting & Finance, 31(*2), 47–53. https://doi.org/10.1002/jcaf.22433.

Widuri, R.; O'connell, B. & Yapa, P. W. W. (2019). Adopting generalized audit software: an Indonesian perspective. *Managerial Auditing Journal, 31*(8/9), 821-847. https://doi.org/10.1108/MAJ-10-2015-1247

Witte, A. L. (2020). *Technology Based Audit Tools: Implications for Audit Quality.* (Tese de doutorado, Setor de Contabilidade, Bentley University). https://scholars.bentley.edu/cgi/viewcontent.cgi?article=1000&context=etd_2020

Youssef, A. B.; Hadhri, W. & MeharzI, T. (2015). Adoption of Cloud Computing in Emerging Countries: The Role of the Absorptive Capacity. *Systèmes d'Information et* Management, 20(4), 117-142. DOI: 10.3917/sim.154.0117

Zahra, S. A. & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization and Extension. *The Academy of Management Review, 27*(2), 185-203. https://doi.org/10.2307/4134351.

Zhu, K. & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information systems Research, 16* (1), 61–84. https://doi.org/10.1287/isre.1050.0045.