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Auditors' Perceptions of the Triggers and Obstacles of Continuous Auditing and Its Impact on Auditor Independence: Insights from Egypt

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Abstract: Our study explores auditors' perceptions of the triggers and hurdles of implementing continuous auditing (CA) in Egypt. It also explores auditors' perceptions of the impact of CA on their independence. A survey of ninety-five auditors working in Big Four and non-Big Four firms was conducted to gather data. Descriptive statistics and the Friedman test were used to test our hypotheses. In addition, using the Mann–Whitney U test, we delve deeper into auditors' perceptions to examine differences across audit firm types. The results reveal that addressing the increasing demand of stakeholders for real-time reporting and enhancing the quality of financial reporting significantly affect auditors' perceptions of the triggers for adopting CA. In addition, the lack of standards related to CA and the high cost of implementation significantly affect auditors' perceptions of the obstacles to implementing CA. The lack of clear guidelines regarding the work required in CA and auditing data that the auditors have previously corrected during the CA process is perceived by auditors as among the most significant factors that can impair their independence. The significance of this study stems from the fact that it is one of the few studies to explore continuous auditing practices in developing countries. To the best of our knowledge, this study is one of the first to investigate how CA affects auditor independence in developing countries.

Keywords: continuous auditing; independence; Egypt

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1. Introduction

Over the past few decades, the business environment has undergone substantial changes such as increasing globalization, intensified competition, rapid technological advancement coupled with the widespread use of the Internet, growing financial fraud, and scandals such as the Enron, Tyco, and WorldCom cases (Sun et al. 2015; Tarek et al. 2017; Hassan et al. 2023). Driven by advancements in information technology, users of financial information are beginning to require more timely disclosure of financial information (Shin et al. 2013). To satisfy users' needs, organizations have leveraged new technological developments to ensure frequent disclosure of financial information and reports on a real-time basis (Rezaee et al. 2018). These changes necessitate the continuous monitoring and evaluation of companies' internal control and risk management systems. However, traditional auditing cannot keep pace with fast-paced environments that require a prompt response to emerging risks and real-time accounting systems (Sun et al. 2015). Auditors are pushed to find innovative methods to satisfy stakeholders' needs and to cope with the regulatory pressures placed on them (Charlton and Marx 2009). Thus, continuous auditing (CA) was introduced to support real-time assurance and satisfy the needs of shareholders and regulators.

CA was defined in 1999 by the American Institute of Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA) as "a methodology for issuing audit reports simultaneously with, or a short period of time after, the occurrence of the relevant events" (Alles et al. 2006b, p. 213). CA has been perceived as a way to restore auditors' creditability in light of the surge in corporate scandals that have been sweeping the business world (Du and Roohani 2007).

Since its introduction more than 30 years ago (Vasarhelyi and Halper 1991), CA has received considerable interest from professionals and researchers. There is a common belief among many researchers (Charlton and Marx 2009; Farkas and Murthy 2014; Sun et al. 2015; Hassan et al. 2023) that the introduction of the Sarbanes–Oxley Act (SOX) in 2002 by the US government has stressed the value of CA. Taking advantage of digitalization and automation, CA can enable auditors to constantly monitor risks and internal control systems, which can significantly contribute to the effectiveness of internal and external auditing processes and reduce the risk of fraud, thereby boosting the confidence of shareholders and regulators in the financial information that fits with SOX goals (Charlton and Marx 2009). According to Alles et al. (2008), companies that utilize CA are well prepared to satisfy SOX requirements by promoting a proactive internal control monitoring system.

Various research streams have been conducted to study CA. Researchers have investigated various aspects of CA, such as its nature (Alles et al. 2006b; Rezaee et al. 2018; Hassan et al. 2023), adoption status (Rezaee et al. 2001; Vasarhelyi et al. 2012), implementation methodologies and frameworks for CA (Du and Roohani 2007; Shin et al. 2013), and feasibility (i.e., benefits and hurdles) of CA (Charlton and Marx 2009; Farkas and Murthy 2014; Lee et al. 2014; Sun et al. 2015; Amin and Mohamed 2016). CA proponents believe that it can offer substantial benefits to auditors, including reducing the overall cost and time of the auditing process, prompt error detection, and enhancing the efficiency and effectiveness of assurance (Amin and Mohamed 2016; Rezaee et al. 2018). Companies can also benefit from CA by enhancing risk management and internal control systems, improving operational efficiency, enhancing data integrity and reliability, and timely disclosure of financial information (Shin et al. 2013; Gonzalez and Hoffman 2018). To reap these benefits, many companies, such as Siemens, AT&T, and Proctor & Gamble, have adopted CA (Farkas and Murthy 2014).

Although CA was perceived to have revolutionized the auditing profession when it was introduced, its use in practice has been slow, especially in developing countries (Gonzalez et al. 2012). This can be attributed to the fact that the adoption of CA would require radical changes in client organizations, such as investing in IT technologies, employee qualifications in terms of IT skills, and enhancing the efficiency of internal audit departments, which cannot be afforded by all organizations (Vasarhelyi et al. 2012).

This study aims to explore auditors' perceptions of triggers and obstacles in providing CA services in Egypt. It also explores auditors' perceptions of the factors that may impair their independence while practicing CA in Egypt. The paper aims to contribute to the research stream of continuous auditing in developing countries, which is still in its infancy stages. Egypt is undergoing a complete economic reform program and restructuring to attract foreign investments and realize high and sustainable growth rates. Egypt has witnessed many amendments to laws and regulations, corporate governance, and related disclosures to enhance transparency and build the public's and investors' trust in the reform program (Abdel-Meguid 2021). This makes Egypt an interesting context to explore CA as it can act as a robust audit mechanism to enhance investor trust in the financial system.

The remainder of this paper is organized as follows. Section 2 provides a review of the extant literature and hypothesis development. Section 3 discusses the research methodology. Section 4 presents and discusses the results. Finally, the conclusions are presented in the final section.

2. Theoretical Background and Hypothesis Development

2.1. Theoretical Background

The concept of CA emerged in the late 1980s (Groomer and Murthy 1989) and the early 1990s (Vasarhelyi and Halper 1991). Since then, interest in CA has increased among practitioners and academics alike (Chan and Vasarhelyi 2011). Several definitions of CA have been reported in the literature. For instance, Rezaee et al. (2001, p. 151) define CA "as a systematic process of gathering electronic audit evidence as a reasonable basis to render an opinion on the fair presentation of financial statements prepared under the paperless, real-time accounting system". Additionally, Helms and Mancino (1999) describe CA as the utilization of software tools to identify irregularities predetermined by auditors within the processed transactions that are monitored in environments operating in a real-time or close to real-time manner. Such irregularities would be immediately examined or recorded in an audit log for later analysis (Helms and Mancino 1999).

Many academic papers (Chiu et al. 2014; Sun et al. 2015; Eulerich and Kalinichenko 2018) contend that the definition of CA most widely recognized is the one put forth by the American Institute of Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA) in 1999. According to the AICPA/CICA's research report in 1999, "a continuous audit is a methodology that enables independent auditors to provide written assurance on a subject matter for which an entity's management is responsible, using a series of auditor reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter" (Alles et al. 2006a).

Stemming mainly from the notion of the AICPA/CICA's definition, Eulerich and Kalinichenko (2018) identify CA as an electronic system designed to provide ongoing, automated monitoring of specific "audit objects" using established criteria. It detects and flags irregularities or deviations from predetermined standards or benchmarks, promptly notifying auditors to take prompt action (Eulerich and Kalinichenko 2018). Similarly, Bumgarner and Vasarhelyi (2015) argue that CA consists of four elements. First, a "Continuous Data Audit" focuses on evaluating and verifying data reliability between systems during input and data processing. Second, "Continuous Control Monitoring" focuses on using technology to conduct ongoing reviews of process-based and system-based controls to ensure their efficiency and effectiveness. Third, "Continuous Risk Monitoring and Assessment" concentrates on assessing and evaluating risk factors, which can help develop internal audit plans. Fourth, "Continuous Compliance Monitoring" emphasizes using technology to monitor the degree to which organizations comply with regulations by creating thorough classifications of regulatory compliance issues and updating regulatory changes.

Recently, the need for CA has become apparent. This can be attributed to advances in information technology, accounting information systems, widespread internet corporate disclosure, and the use of social media to disclose financial information, enabling companies to produce real-time, high-volume financial data and information (Chan and Vasarhelyi 2011). Although a high volume and real-time information can be advantageous to businesses, they can increase errors and business risks. Auditors are required to provide ongoing and timely assurance of data quality and to continuously test and evaluate the adequacy of clients' control systems for irregularities, inconsistencies, errors, and fraud on a nearly continuous basis (Rezaee et al. 2018; Diab 2021; Sundarasen et al. 2024). However, traditional backward-looking auditing cannot keep pace with these requirements, as auditors evaluate and test the control systems on a yearly basis when a financial statement audit begins (Pathak et al. 2005). Even then, auditors test only a sample of transactions, which is unlikely to make them certain about the veracity of the data and information (Pathak et al. 2005).

Another reason is the international financial scandals that have hit the business world and snowballed into a loss of confidence in financial and auditor reports (Sun et al. 2015; Sundarasen et al. 2017). The introduction of SOX in 2002 increased the need for continuous reporting as it was deemed necessary to enhance the transparency of financial information and stimulate the confidence of regulators and shareholders (Sani and Nwite 2021). Under

Section 404, companies must report on the adequacy of internal control systems, while Section 409 requires rapid disclosure of significant changes in a company's financial position (El-Masry and Reck 2008). Compared to traditional auditing, CA provides real-time reports that can be made available immediately or within a short period of time instead of once a year, necessitating continuous monitoring of internal control systems (Hassan et al. 2023). Therefore, CA has been proposed as a way to meet shareholders' and regulatory requirements and alleviate the limitations of traditional auditing (Farkas and Murthy 2014).

CA is a technology-driven concept. Therefore, auditors would need to use technological tools to conduct CA. Auditors can use computer-assisted audit tools and techniques (CAATTs) to gather evidence, assess risks, and perform auditing procedures (Rezaee et al. 2018). Auditors should have access to auditees' information systems to install auditing modules within the clients' information systems, accumulate audit evidence, and continuously monitor these systems (Amin and Mohamed 2016). Other factors that facilitate the implementation of CA in client organizations include management support, highly reliable client information systems, organizational structure of the internal audit department, and employee knowledge (Vasarhelyi et al. 2012; Soedarsono et al. 2019).

Research on CA in developing countries is still in its early stages (Tarek et al. 2017; Sani and Nwite 2021; Federicco and Tandiono 2023). Amin and Mohamed (2016) investigated the impact of CA implementation on the quality of internet-reported financial information in Egypt and found that CA yields positive outcomes in this context. Similarly, Tarek et al. (2017) explored the diffusion and perceptions of Egyptian auditors regarding the influence of technology in auditing, concluding that auditors' views on IT system complexity are influenced by both the involvement of IT specialists and their own IT expertise. In Indonesia, Soedarsono et al. (2019) identified a positive relationship between information quality, management support, and the successful implementation of CA. Wahdan et al. (2020) examined the effect of CA within an ERP environment on internal audit performance in Egypt and highlighted the potential of CA to improve the quality of internal audits. In contrast, Sani and Nwite (2021) investigated the barriers to CA implementation in Nigeria, identifying factors such as ineffective internal controls, auditors' inability to access real-time client data, and insufficient automation as key hindrances. Finally, Federicco and Tandiono (2023) assessed the awareness of auditors in Indonesia regarding the benefits of CA, revealing that while auditors generally have a positive perception of CA's advantages, they are concerned about the availability of necessary facilities for its adoption. Unlike the previous research, our paper aims to contribute to the existing body of CA literature in developing countries by exploring the triggers and obstacles to CA adoption in Egypt and the impact of CA on Egyptian auditors' independence.

2.2. Hypotheses Development

CA has been introduced since its inception as a practice that will revolutionize auditing. Interest in CA adoption has increased rapidly. The triggers for CA adoption have been discussed in the literature, such as reducing the overall cost of performing the auditing services (Amin and Mohamed 2016; Gonzalez and Hoffman 2018; Rezaee et al. 2018), enhancing the quality and reliability of financial information and reporting (Warren and Smith 2006; Gonzalez et al. 2012; Rezaee et al. 2018), addressing the increasing demand of stakeholders for real-time reporting (Alles et al. 2008; Charlton and Marx 2009), and responding to rapid IT advancement compromising auditing (Chan and Vasarhelyi 2011; Amin and Mohamed 2016; Wahdan et al. 2020). Therefore, the first hypothesis is as follows:

H_1: *Egyptian auditors apply equal importance to the triggers of CA adoption.*

Compared with the overly optimistic picture of CA at its inception, many companies are still reluctant to adopt this concept because of the challenges it brings. The high cost of implementing CA (Warren and Smith 2006), insufficient IT skills and training among auditors (Amin and Mohamed 2016; Wahdan et al. 2020), lack of standards related to CA (Amin and Mohamed 2016), and lack of technical support when needed (Hazar 2021) are

among the challenges that CA can bring. In addition, the complexity of the procedures required to conduct CA processes can be regarded as one of these challenges. Therefore, the second hypothesis is as follows:

H_2: *Egyptian auditors place equal importance on obstacles that may hinder the adoption of CA services.*

Internal and external auditors play vital roles in the successful implementation of CA. Internal auditors must continuously monitor systems, identify high-risk processes, and report irregularities in management (Jans and Hosseinpour 2019). External auditors can help in analyzing CA systems and act as an "insurer against materially faulty financial information generated by a certified internal audit CA system" (Chan and Vasarhelyi 2011, p. 156). However, many researchers have raised concerns about whether CA can impair or threaten auditor independence (Shin et al. 2013; Farkas and Murthy 2014; Amin and Mohamed 2016). Previous studies have confirmed that conducting non-audit services to audit clients can threaten an auditor's independence (Frankel et al. 2002; Warren and Smith 2006). This can still occur while implementing CA for audit clients. Several factors identified by researchers may compromise external auditor independence when implementing CA services for audit clients. Among these factors are auditing data that the auditor has previously corrected during the CA process (Alles et al. 2008; Farkas and Murthy 2014), accessing audit clients' accounting systems and embedding IT tools within the systems (Amin and Mohamed 2016), designing and developing client's systems and associated controls while conducting CA service (Farkas and Murthy 2014), no clear guidelines available regarding the work needed in CA, which causes confusion among auditors (Amin and Mohamed 2016), CA service fees lessening auditors' independence (Alles et al. 2018) and lengthy audit engagement tenure hindering auditors' ability to act independently (Anis 2014; Rajgopal et al. 2021). In addition, the demand by shareholders, regulators, and other stakeholders for CA and their expectations from auditors are continuously increasing at an accelerated pace (El-Masry and Reck 2008), which can put more pressure on auditors and compromise their independence. Therefore, one of the objectives of this study is to examine Egyptian auditors' perceptions of the factors that can compromise their independence while conducting CA services in response to the call of Amin and Mohamed (2016) to investigate the effect of implementing CA on auditor independence. Thus, the third hypothesis is as follows.

H_3: *Egyptian auditors apply equal importance to factors that may impair their independence during continuous auditing.*

3. Research Methodology

The research methodology used in this study is discussed in terms of the sample, instrument used, reliability test, and methodology.

3.1. Sample

The population of this study consists of auditors registered with the Egyptian Financial Supervisory Authority (EFSA) in 2022. One hundred and ninety-two questionnaires were sent to auditors via e-mail and LinkedIn accounts. One hundred and fifteen questionnaires were received, of which ninety-five were completed, and twenty were incomplete, with a roughly 50 percent response rate after excluding incomplete questionnaires.

3.2. Instrument

A two-section questionnaire was developed to test the hypotheses. The first section included questions about the respondents' demographic characteristics. These characteristics include respondents' gender, age, educational qualifications, job title, and IT expertise level, as well as their auditing firm type and level of automation. All the questions in this section were closed in a multiple-choice format. The second section explores Egyptian auditors' perceptions of the triggers for adopting CA, obstacles that preclude its implementation, and

factors that may impair their independence. Egyptian auditors were asked to rank their perceptions according to a five-point Likert scale ranging from one as not important to five as very important. To ensure the understandability of the questionnaire and reduce bias by removing any leading questions that may skew participants' responses, a pilot study was conducted with five professional auditors. After considering their comments, a final questionnaire was developed and submitted to the target group.

3.3. Reliability Test

To ensure the reliability of the questionnaire, Cronbach's alpha coefficient, the most common measure of scale reliability (Field 2013), was used to assess the internal consistency of the questionnaire. Table 1 shows the reliability statistics of Cronbach's alpha coefficient for the 16 items, which was 0.90. As a rule of thumb, Cronbach's alpha coefficient must be greater than 0.7, indicating good reliability (Field 2013). Accordingly, our results indicate acceptable levels of overall reliability for the Likert-scale questions.

Table 1. Reliability Statistics (Cronbach's alpha coefficient).

	Cronbach's Alpha	N of Items
Overall Reliability	0.90	16

3.4. Method

The questionnaire responses were first coded and then analyzed using SPSS. To gain a general understanding of the main variables, descriptive frequency statistics were conducted. Friedman test was used to determine the priority of triggers of CA implementation, obstacles that hinder CA implementation, and factors that may impair auditors' independence when providing CA services. Additionally, the Mann–Whitney U test was performed to understand the impact of the audit firm type on auditors' perceptions regarding the triggers and challenges of CA and factors affecting auditors' independence.

4. Results and Discussion

4.1. Descriptive Analysis

Table 2 displays the demographic characteristics of the ninety-five participants. Panel A presents descriptive statistics based on Egyptian auditors' personal attributes. The majority of respondents were male (84%), with a smaller proportion being female (16%). Nearly 90% of the participants were below the age of 40 years, indicating that the findings predominantly reflect the perspectives and preferences of middle-aged respondents. The educational distribution revealed that more than three-quarters of the respondents held a bachelor's degree (77%). The distribution of position titles includes partners (3%), senior auditors (28%), staff auditors (40%), audit managers (8%), and others (20%). Finally, respondents were equally divided based on their IT expertise levels, with 97% possessing high to moderate IT skills and only 3% having novice IT skills.

Moving to Panel B, Table 2 provides insights into the attributes of respondents' auditing firms. More than half of the participants (54%) worked in Big Four audit firms, while the remaining respondents (46%) were employed in non-Big Four (local) firms. The overwhelming majority (92%) are employed in audit companies that are either fully or partially automated, and a small percentage (8%) indicate their companies' intention to automate their auditing processes in the near future.

Table 2. The Descriptive Statistics of the Sample's Respondents.

		Frequency	Percentages
Panel A, The respondents' Personal Attributes			
Gender	Female	15	16
	Male	80	84
Age	Less than 30 years old	65	68
	30–40 years old	20	21
	40–50 years old	3	3
	Over 50 years old	7	7
Educational Qualifications	Bachelor's degree	73	77
	Professional Certificates	13	14
	Postgraduate (Diploma, Master or PhD)	8	8
	Other	1	1
Job Title	Partner	3	3
	Senior auditor	27	28
	Staff auditor	38	40
	Audit Manager	8	8
	Other	19	20
Respondents' IT Expertise level	Expert	41	43
	Intermediate	51	54
	Fair	3	3
Panel B, The Attributes of Respondents' Auditing Firms			
Audit Firm Type	Big Four Companies	51	54
	Non-Big Four Companies	44	46
Level of Automation	Fully automated	30	32
	Partially automated	57	60
	Manual with future plans to automate	8	8

Table 3 shows a descriptive analysis of the frequency of Egyptian auditors using IT technologies to conduct CA activities. The findings indicate the prevalent use of Excel, Oracle, and SAP as primary software packages and tools among Egyptian auditors for Continuous Assurance (CA) activities. By contrast, ATLAS.ti, Canvas, and eAudIT are less commonly employed. This observation highlights the diversity of software preferences among Egyptian auditors engaged in CA, reflecting distinct trends and practices in technology adoption within the auditing domain.

Table 3. Frequencies and Percentages of IT Technologies utilized in Egyptian Auditing Firms.

	Frequency	Percentage
Excel	36	38
Oracle	13	14
SAP	11	12
Artificial Intelligence Technologies	8	8
Cloud-based Application	8	8
IDEA	4	4
QuickBooks	4	4
Voyager Software	3	3
APT audit software	2	2
ATLAS.ti	2	2
Canvas	1	1
EAudIT	1	1
Other	2	2
Total	95	100

4.2. Hypotheses Testing

4.2.1. Triggers of Adopting CA Services

The extant literature emphasizes a range of triggers that could prompt auditors to deliver CA services. To gauge the perceived significance of these triggers from the perspective of Egyptian auditors, participants were asked to assess their motivation to offer CA based on a 5-point Likert scale. As shown in Table 4, at 0.05 confidence interval and three degrees of freedom, the chi-square value (x^2 = 30.44) is higher than the tabulated chi-square value (x^2 = 8.215). In addition, the observed significance *p*-value = 0.000 is lower than the significance threshold of 0.05, implying that, based on Egyptian auditors' perceptions, the ranking of the importance of their triggers in providing CA services is statistically significant; thus, the null hypothesis H_1 is not supported.

Table 4. Incentives of Providing CA Service: Friedman's Test Statistics.

N	95
Chi-Square	30.44
Df	3
Asymp. Sig.	0.000

Table 5 presents the outcomes of the important ranking of auditors' triggers for providing CA services arranged in descending order based on their mean rank. The results indicate that the foremost incentive driving Egyptian auditors to engage in CA is the need to meet stakeholders' rising demand for real-time reporting, with a mean rank of 2.72. Byrnes et al. (2015) highlight the pivotal feature of CA, as implied by its capacity to provide timely information. In contrast to the reactive nature of traditional external auditing, which relies on annual sampling, CA can proactively address or prevent issues in identified risk areas (Byrnes et al. 2015). Similarly, Gonzalez and Hoffman (2018) posited that CA ensures real-time or near-real-time coverage of all transactions, departing from sampling and post-transaction recording audits for a more immediate and comprehensive examination of financial activities. Concurrently, Rezaee et al. (2018) asserted that the increasing prevalence of e-commerce necessitates a shift toward paperless, electronic, online, and real-time continuous audits. Aligned with this perspective, Amin and Mohamed (2016) and Wahdan et al. (2020) posit that Egyptian auditors acknowledge the imperative of CA in capturing rapid advancements in the auditee's IT environment and addressing the growing complexity of business transactions.

Table 5. Friedman Test to Rank the Importance of Auditors' Incentives of to adopt CA.

Items	Mean	Std. Deviation	Mean Rank	Importance Rank
Reducing the overall cost of performing the auditing services.	4.27	0.710	2.60	3
Enhancing the quality and reliability of financial information and financial reporting.	4.36	0.670	2.64	2
Addressing the increasing demand of stakeholders for real-time reporting.	4.34	0.660	2.72	1
Responding to the rapid IT advancement compromising auditing.	3.75	0.980	2.10	4

Egyptian auditors' aspirations for enhancing audit quality and ensuring the reliability of financial reports are the second most significant motivator (mean rank = 2.64). The pursuit of initiatives aligned with corporate governance and the bolstering of stakeholder confidence presents a substantial opportunity for CA adoption, facilitating real-time assurance (Warren and Smith 2006). Additionally, CA is viewed as a prominent solution for elevating the quality of auditing processes (Gonzalez et al. 2012). CA empowers auditors

to navigate the complexities of clients' accounting information systems and addresses the connections between business transactions. This functionality is crucial for preventing the spread of identified errors and fraud from one process to another, thereby enhancing audit quality (Chan and Vasarhelyi 2011). Furthermore, drawing on Korean data, Lee et al. (2014) furnish empirical evidence showcasing a negative association between CA and discretionary accruals in both interim and annual reporting, supporting the idea that CA contributes to the enhancement of financial reporting quality. According to Sun et al. (2015) and Hassan et al. (2023), CA implementation significantly improves auditor capabilities, resulting in the detection of irregularities and fraud. Consequently, this enhances the information transparency, timeliness, and reliability of financial reporting. Furthermore, CA and its integrated digital technologies enable auditors to analyze the entire dataset instead of relying solely on sampling. This approach reduces the likelihood of issuing an inaccurate audit opinion (Otia and Bracci 2022). These findings are also consistent with the government's efforts to strengthen corporate governance and enhance transparency to attract foreign investors. CA allows auditors to fully grasp the internal control systems of companies and continuously monitor these systems which can reduce the risk of misstatements and fraud and allow more transparent disclosure of the results of operations to achieve blessed results for stakeholders (Eulerich et al. 2024). While Egypt has recently witnessed structural changes in its economic and governance framework, and steps have been taken in the right direction, there is still considerable room for improvement in accounting and auditing practices (Elbayoumi et al. 2019; Aladwey 2021). Consequently, it is anticipated that Egyptian auditors will turn to the CA to align with the government's efforts to enhance governance and disclosure structures.

Auditors in Egypt consider mitigating audit-processing costs the third crucial factor that may prompt them to offer CA, with a mean score of 2.60. A potential justification for this perspective is the extended duration it takes for audit firms to realize cost savings in the auditing process, following the adoption of CA. Hardy and Laslett (2015) argued that the positive outcomes of providing CA services outweigh its costs, but the challenge lies in its adoption. They assert that while the adoption of CA has significant benefits, its implementation is a complex task that requires extended lead times, sophisticated technical infrastructure, and recognized financial resources. Additionally, Hazar (2021) indicated that the cost of CA implementation in the long run is lower than that of traditional auditing. This is attributed to the multi-use capability of CA software, which enables numerous auditing procedures to be conducted more efficiently in terms of time and effort.

With a mean rank of 2.10, the least motivating factor was the need to adapt to technological challenges for effective integrity-preserving auditing processes. This statement implies the need for auditors to adapt, adjust, or find solutions to ensure the effectiveness and integrity of the auditing processes in the face of technological challenges. Amin and Mohamed (2016) align with this, noting that Egyptian auditors recognize the utility of CA in addressing the challenges associated with online reporting. Despite acknowledging that audit firms offering CA services can enhance the qualitative characteristics of financial reporting on the Internet, Egyptian auditors rank the incentive of Internet financial reporting as the least important factor driving them to conduct CA. This may be attributed to the voluntary nature and limited prevalence of Internet financial reporting among Egyptian-listed companies (Ahmed et al. 2017; Ahmed et al. 2018).

4.2.2. Obstacles of CA Adoption

Despite the positive outcomes associated with CA, as indicated in the literature (e.g., Amin and Mohamed 2016; Polizzi and Scannella 2023), it is considered a relatively novel practice in the Egyptian audit market. As outlined in Table 6, the chi-square value (x^2 = 33.165) exceeded the tabulated chi-square value (x^2 = 9.798) at a confidence interval of 0.05, with three degrees of freedom. The significance level related to the test was 0.001, leading to the rejection of the null hypothesis H_{2a} at a significance threshold of 0.05. Con-

sequently, the results suggest a divergence in auditors' perceptions of the importance of obstacles hindering the application of CA in Egyptian auditing companies.

Table 6. Obstacles to adopt CA Service: Friedman's Test Statistics.

N	95
Chi-Square	33.165
Df	4
Asymp. Sig.	<0.001

Table 7 presents the mean importance rank of obstacles that might hinder Egyptian auditors from engaging in CA. The most significant challenge, with a mean rank of 3.65, was the absence of auditing standards suitable for CA. This finding aligns with Ismail and Sobhy (2009), who identified a similar concern among Egyptian auditors, highlighting the lack of standards and guidelines clarifying auditing procedures for Internet-based financial reporting as a primary barrier. Amin and Mohamed (2016) also emphasized the deficiency of auditing standards in addressing issues related to auditing real-time data. They suggest that regulatory bodies in Egypt should revisit contemporary auditing standards to align with CA requirements for optimal utilization. Additionally, Elbayoumi et al. (2019) attribute the slow regulatory response in Egypt to regulators' insufficient monitoring of accounting and auditing practices, in line with the evolving business environment.

Table 7. The Importance Rank of Obstacles to Adopt CA: Egyptian Auditors' Perceptions.

	Mean	Std. Deviation	Mean Rank	Importance Rank
Insufficiency of IT skills and training among auditors.	3.95	0.820	3.00	3
The complexity of procedures required to conduct CA processes.	3.61	1.170	2.62	5
The unavailability of technical support when needed.	3.80	0.990	2.80	4
High cost of implementing CA.	3.92	0.815	3.05	2
Lack of standards related to CA.	4.35	0.710	3.65	1

With a mean rank of 3.05, the high cost of facilities and infrastructure required to provide CA services was identified as the second barrier, as shown in Table 7. This finding aligns with the arguments of Warren and Smith (2006) and Hall (2015), who assert that auditing firms acknowledge the significant costs associated with the development and adoption of CA. Several factors contributed to this phenomenon. First, the specific format of clients' IT systems may necessitate customized requirements for the CA software provided by the audit firm, creating complexities that vary from client to client. Additionally, the high cost of CA software may be feasible for larger auditee companies but deemed unreasonable for smaller companies, potentially limiting the client base of auditing firms (Warren and Smith 2006). Second, CA involves CAATTs such as the test data method, integrated test facilities, and generalized audit software to assist auditors in testing client application controls and extracting data. However, these techniques are relatively expensive to implement and maintain (Hall 2015). Mudawanah et al. (2024) argued that, compared to small and medium-sized enterprises (SMEs) with limited resources, larger auditing companies may afford the main facilities required to adopt CA due to their financial capabilities.

The third impediment to conducting CA from the perspective of Egyptian auditors is the scarcity of qualified auditors with adequate IT skills and training, with a ranking mean of 3 in Table 7. This challenge is consistent with the findings of Samaha and Hegazy (2010), who point out that the Egyptian auditing market faces a shortage of qualified auditors. The materials taught about auditing standards at Egyptian universities fall short of covering contemporary auditing practices. Additionally, Ismail and Sobhy (2009) and Amin and Mohamed (2016) reveal that confusion and uncertainty among Egyptian auditors regarding

the procedures required for auditing Internet-based financial reporting stems from their insufficient IT auditing skills and training. Anis (2017) addressed a broader gap in the Egyptian context by noting disparities between the accounting skills acquired from courses and those demanded by professional auditing firms, including IT. Furthermore, Wahdan et al. (2020) elucidated the inadequacy of Egyptian Auditing Standards (EAS) and the deficiency in the level of expertise, training, and skills of Egyptian auditors to cope with technological advances and handle data in real-time.

The fourth significant challenge involves the absence of readily available technical support, as indicated by the mean rank of 2.80. Given that CA requires auditors to be well-versed in audit package software to execute audit procedures and understand the client's electronic system and associated technological risks and hazards (Vasarhelyi and Kuenkaikaew 2009; Tarek et al. 2017; Hazar 2021), the presence of technical assistance and effective communication with system administrators becomes crucial. Regrettably, Abou-El-Sood et al. (2015) argue that the field of IT audits is underdeveloped in the Egyptian auditing market. Anis (2017) contends that accounting graduates in Egypt lack adequate IT knowledge and skills. Consequently, it is anticipated that Egyptian auditors may not be well acquainted with automation in IT auditing and may encounter difficulties in accessing the necessary technical support when required.

The degree of complexity in the procedures required to conduct CA processes is the least important barrier hindering Egyptian auditors' provision of CA services, with a mean rank of 2.62. This finding aligns with the results of Ismail and Sobhy (2009), who assert that Egyptian auditors possess fair awareness of the auditing procedures and techniques required to audit internet-based financial reporting. Similarly, Abou-El-Sood et al. (2015) indicate that while Egyptian auditors acknowledge the importance of IT technology in enhancing audit quality, they maintain a suboptimal level of skills, training, and understanding of the audit work needed to practice CA.

4.2.3. The Impact of CA Adoption on Auditor's Independence

Based on priority importance, respondents were asked to rank the factors that may invade auditors' independence while practicing CA. Table 8 shows the test statistic of the chi-square value (x^2 = 28.715), which is higher than the tabulated chi-square value (x^2 = 13.192) at 0.05 threshold and a degree of freedom of six. In addition, the table also shows that the value of chi-square is significant, where *p*-value = 0.001 is lower than the significance threshold of 0.05, suggesting that there is an overall statistically significant difference between the mean ranks of the factors that may invade auditors' independence while conducting CA. Accordingly, we conclude that we reject the null hypothesis H_{3a}.

Table 8. CA adoption and auditors' independence: Friedman's Test Statistics.

N	95
Chi-Square	28.715
df	6
Asymp. Sig.	0.001

Table 9 shows the mean rank and importance rank of such factors, as perceived by Egyptian auditors. The results reveal that the most challenging factor that may raise independence issues is auditors' confusion regarding their roles within the CA, with a rank importance of 4.59. Empirical evidence from the literature highlights the prevalent confusion regarding auditors' core duties in Egypt and their impact on independence. Samaha and Hegazy (2010) indicate this confusion by claiming that Egyptian auditors may participate in their auditees' activities, such as taking part in preparing financial statements and supplemental notes and helping in conducting decisions related to year-end accounts. In addition, Wahdan et al. (2020) and Mohamed and Habib (2013) indicate that there is no clear distinction between auditing and consulting services within the Egyptian auditing

market, as auditors may be occupied in settling tax issues with tax agencies more than engaging in auditing and assurance services. Similarly, Mostafa et al. (2020) argue that a significant reason for the lack of independence among auditors in Egypt is their tendency to prioritize offering tax consulting services to ensure the fairness of financial reporting. According to Amin and Mohamed (2016), the future of Internet financial reporting in Egypt is very promising, and standard-setters, government, and all other interested parties should prepare themselves to cope with this upcoming growth. The development of integrated guidance that prescribes CA activities and procedures is necessary. Moreover, accounting and auditing regulators should develop rules to settle independence and materiality issues that may face Egyptian auditors while practicing CA (Amin and Mohamed 2016).

Table 9. The Importance Rank of factors impair auditors' independence while practicing CA: Egyptian Auditors' Perceptions.

Items	Mean	Std. Deviation	Mean Rank	Importance Rank
Designing and developing client's systems and associated controls	3.72	1.125	4.26	3
Auditing data that the auditor has previously corrected during the CA process.	3.70	1.048	4.32	2
Accessing audit client's accounting systems and embedding IT tools within the systems.	3.60	1.096	4.03	4
Auditors' tenure	3.25	1.162	3.28	7
Increasing demand by shareholders, regulators, and other stakeholders for CA and their expectations from auditors	3.46	1.153	3.83	5
No clear guidelines are available about the work needed in CA which has caused confusion among auditors	3.85	1.140	4.59	1
CA services fees can lessen auditor's independence	3.46	1.287	3.80	6

The second element that could impact auditors' independence is the examination of the data previously rectified by the auditor during the CA process (mean rank = 4.32). Warren and Smith (2006) claim that although discussions about CA can include both internal and external auditors, certain management executives may be reluctant to engage external auditors in these conversations because of concerns regarding auditors' independence. Alles et al. (2008) argued that in a CA environment, the prompt detection of anomalies triggers immediate notification to the auditor, initiating a comprehensive investigation and subsequently leading the auditors to gain the opportunity to rectify the identified error prior to the commencement of the subsequent audit round. Whether this technical opportunity is practical depends on how quickly errors can be fixed. Additionally, a pivotal concern emerges pertaining to the potential compromise of auditor independence, specifically in the utilization of data for subsequent tests in which the auditor has actively engaged in rectifying errors (Alles et al. 2008; Farkas and Murthy 2014). Accordingly, the evident benefits of real-time error correction in a CA environment are accompanied by significant concern: if auditors spontaneously intervene in fixing errors, there is a potential risk of influencing audit results and compromising their independence (Alles et al. 2008; Polizzi and Scannella 2023).

The assumed role of auditors in designing and developing client systems and associated controls, with a mean rank of 4.26, is the third most significant threat to auditors' independence. As part of the CA, auditors employ IT audit modules to regularly review client systems and business processes and test computer controls consistently. While this practice supports the core responsibility of management, it also introduces the potential risk of compromising auditor independence (Warren and Smith 2006). The proactive nature of CA may lead auditors to assume a "monitorer" role beyond their traditional role as assurors (Chan and Vasarhelyi 2011). Over time, auditors may find themselves taking

ownership of client transactions. Bumgarner and Vasarhelyi (2015) note that when errors or fraud are detected, CA facilitates tracking and correcting them from their origin. This process may contribute to confusion among auditors, blurring the lines between their core role in providing assurance services and their involvement in correcting errors and fraud. Amin and Mohamed (2016) emphasized that auditors should refrain from consistently alerting management about detected irregularities or participating in the design of client control systems to preserve their independence. A delicate balance between proactive auditing and maintaining the traditional role of auditors is crucial to uphold independence and ensure the integrity of the auditing process.

The fourth factor identified as potentially causing independence issues is access to audit clients' accounting systems and the integration of IT tools within these systems, as indicated by a mean rank of 4.03. CA permits the utilization of various tools and techniques, such as generalized audit software, CAATTs, and spreadsheet software, to gather necessary audit evidence (Zoet et al. 2020). Auditors require authorized access to client data files or programs to employ these tools. However, auditees' concerns regarding the privacy and security of their data pose a significant challenge that may impede the widespread adoption of CA (Alles et al. 2013; Bumgarner and Vasarhelyi 2015). Tarek et al. (2017) emphasized the risks associated with IT auditing, including virus attacks, hacking, repudiation, fraud, manipulation, and unauthorized access to data. They highlight the importance of auditors' awareness of such risks to effectively detect and address them. Imoniana et al. (2021) stress the need to verify auditors' independence in ensuring ethically sound audit engagements. This involves preventing unauthorized access to the client's data from individuals outside the engagement team or restricting such access only when necessary. Control procedures within the client firm play a crucial role in governing how IT auditing tools are employed. Failure to implement these procedures properly could create opportunities to compromise auditor independence. The limited adoption of CA in Egypt (Amin and Mohamed 2016), relatively low prevalence of CAATTs usage by Egyptian auditing firms, and inadequate governance structure of Egyptian companies (Mohamed and Habib 2013) collectively contribute to downplaying the impact of CAATTs on Egyptian auditors' independence.

The fifth threat is pressure stemming from stakeholders' high expectations regarding CA outcomes (mean rank = 3.83). According to Warren and Smith (2006), a survey of the Big Four auditing companies reveals that, due to auditors engaging in real-time data auditing within the CA framework, stakeholders tend to hold over-ambitious expectations regarding the auditor's role. Expectations include providing timely alerts about going-concern issues, detecting fraud, and delivering a higher level of assurance on the quality of disclosed financial information. Alles et al. (2013) note that auditees may anticipate results that do not align with the current state of their companies. Within the realm of CA, theoretical advances in computerized auditing tools may lag behind their actual adoption in practice (Alles et al. 2013). In contrast to traditional auditing, which relies on sampling testing of transactions, CA allows auditors to test the entire population, potentially enhancing audit quality and increasing the likelihood of detecting significant errors, anomalies, and breaches of internal control procedures (Chan and Vasarhelyi 2011). However, it is crucial to acknowledge that population testing in CA does not guarantee the detection of all violations, as management may find ways to undermine or obstruct CA initiatives (Chan and Vasarhelyi 2011). CA caters to the diverse needs of stakeholders. Management benefits from CA procedures that assure the company's data and monitor operations. Stockholders are concerned with CA outcomes related to the assurance of fairness of financial reporting, compliance, and risk monitoring (Bumgarner and Vasarhelyi 2015). By enabling auditors to issue audit reports simultaneously or shortly after processing client data, CA allows real-time assurance to stakeholders (Zoet et al. 2020). These features of CA can heighten stakeholder expectations, creating ongoing pressure on auditors to meet them, even at the risk of affecting their independence.

With a mean rank of 3.80, the sixth threat is that CA service fees can lessen auditors' independence. According to Frankel et al. (2002, p. 7), "*the joint provision of audit and*

non-audit services creates knowledge spillovers that could lead to economic bonding." CA fees can create similar bodings. According to Alles et al. (2018), CA fees can create independent problems. However, our results show that auditors in Egypt do not perceive CA fees as a significant factor that can impair their independence.

According to the findings presented in Table 9, auditors' tenure with their auditees ranked lowest in terms of priority importance (mean rank = 3.28). The debate revolves around the notion that prolonged audit engagement tenure may foster intimacy between auditors and clients, potentially hindering auditors from maintaining independence and objectivity as they may become influenced by client preferences (Anis 2014; Rajgopal et al. 2021). In addition, Anis (2014) notes that Egyptian auditors view an appropriate audit tenure ranging from three to five years, providing sufficient time for auditors to understand clients' specific operations and grasp the governance structure, thereby enhancing audit quality. Beyond this period, Anis (2014) recommended mandatory auditor rotation to prevent threats to auditor independence. Accordingly, despite the apparent advantages of real-time error correction in a CA environment (Polizzi and Scannella 2023), these benefits may compromise auditor independence in cases where long-term relationships lack clear boundaries. In the Egyptian context, Mostafa et al. (2020) highlight the impact of auditors' tenure on independence in the Egyptian context, emphasizing the importance of auditor rotation. Mohamed and Habib (2013) contended that audit firm rotation, as opposed to partner rotation, is a suitable solution to independence issues. They cited two main reasons for this preference: the availability of qualified auditing firms in the Egyptian market and the practice of conducting audit engagements within auditing firms based on partners' expertise in the auditees' business industry. This approach is believed to enhance audit quality and to support auditor independence.

5. Additional Test: Audit Firm Type

Similar to Amin and Mohamed (2016), we further scrutinize auditors' perceptions using Mann–Whitney U based on the audit firm type. The objective is to gain additional insights into the impact of the audit firm type, whether Big Four or non-Big Four, on auditors' perceptions regarding incentives for conducting CA, obstacles hindering CA adoption, and factors affecting auditors' independence. Beginning with the results in Panel A and Panel C of Table 10, it is evident that the audit firm type does not exert any influence on Egyptian auditors' perceptions regarding triggers for adopting CA or the factors that may compromise their independence.

In Panel B of Table 10, the statistically significant relationship between the audit firm type and auditors' perceptions toward obstacles to CA adoption is explored. However, this significance is observed only for the second most important challenge. At a significance level of 0.05, the results show a notable difference in the perceptions of Egyptian auditors working in the Big Four auditing companies and those in non-Big Four companies regarding the cost of implementing and developing CA, with a p-value of 0.04. In alignment with this finding, Tarek et al. (2017) argue that the size of the audit firm influences the extent of its utilization of IT auditing procedures. Big Four auditing firms, having greater resources, are more adept at investing in IT auditing infrastructures and techniques compared to non-Big Four companies. Consequently, Big Four auditing companies may perceive the high cost of CA as justifiable in light of the potential benefits gained from employing IT auditing techniques.

Similarly, Vasarhelyi and Kuenkaikaew (2009) and Vasarhelyi et al. (2012) suggest that internal auditors do not necessarily view the cost of developing and monitoring CA as a major obstacle to its adoption as long as the cost is justified and does not outweigh the benefits. Internal audit departments may consider CA as a critical factor in enhancing internal auditing processes and facilitating up-to-date reporting, leading them to be more inclined to invest in CA (Vasarhelyi et al. 2012).

Table 10. Additional Analysis: Results of Mann–Whitney U Test.

Items	Mann–Whitney U Test	Asymp. Sig.
Panel A, Triggers of adopting CA		
Reducing the overall cost of performing the auditing services.	766.5	0.700
Enhancing the quality and reliability of financial information and financial reporting.	730	0.570
Addressing the increasing demand of stakeholders for real-time reporting.	726	0.601
Responding to the rapid IT advancement compromising auditing.	646	0.162
Panel B, Obstacles of providing CA Service		
Insufficiency of IT skills and training among auditors.	750	0.612
The complexity of procedures required to conduct CA processes.	756	0.769
The unavailability of the technical support when needed.	718	0.500
High cost of implementing CA.	712	0.048
Lack of standards related to CA.	630	0.193
Panel C, CA adoption and Auditor independence		
Auditing data that the auditor has previously corrected during the CA process.	668	0.239
Designing and developing client's systems and associated controls.	753	0.748
Accessing audit client's accounting systems and embedding IT tools within the systems.	776	0.938
Auditors' tenure.	777	0.957
Increasing demand by shareholders, regulators, and other stakeholders for CA and their expectations from auditors.	740	0.650
No clear guidelines are available about the work needed in CA which has confusion among auditors.	757	0.757
Non-audit service fees can lessen auditor's independence.	696	0.375

6. Conclusions

Our study aims to assess auditors' perceptions of the primary factors influencing the adoption of CA, barriers to its implementation, and potential threats to auditors' independence, prioritized by importance rank. The findings indicate varying priority levels among Egyptian auditors regarding their motivations to offer CA services. The primary driver is their eagerness to meet the increasing demands of stakeholders for real-time reporting. Furthermore, according to the importance rank, Egyptian auditors express that they may predominantly turn to CA to improve the effectiveness of their auditing services, reduce audit costs, and adapt to technological advancements in the auditee's IT system.

The findings also indicate that auditors assign varying priority levels to the challenges associated with CA adoption in the Egyptian audit market. Most importantly, auditors identify the lack of official regulations addressing key issues under CA as the primary challenge, attributing this to the noticeable disparity between auditing standards and contemporary auditing practices in Egypt. The second significant obstacle is the high implementation cost driven by the substantial investments required in IT infrastructure and auditor training for CA. Consequently, there is a shortage of skilled auditors and insufficient technical support. The least-prioritized challenge pertains to the complexity of procedures involved in CA processes, stemming from the lack of awareness among Egyptian auditors regarding auditing procedures under CA and the absence of professional guidelines specifying audit tasks and responsibilities within the CA framework.

Regarding threats to independence in the practice of CA, our findings reveal varying priority rankings assigned to each threat by Egyptian auditors. The foremost concerns include auditors' need to clarify their role in CA, auditing data previously corrected during

the CA process, and auditor involvement in designing and developing auditee systems and controls. These factors increase auditors' sense that their role is to participate in developing and maintaining robust control procedures rather than assuring that such procedures are undertaken. Additionally, accessing the accounting systems of an audit client and incorporating IT tools may jeopardize auditor independence due to concerns about auditees' privacy and data security. Stakeholder pressure to improve audit quality and CA service fees can compromise auditors' independence. Finally, the long-term relationship between auditors and client firms and the nature of CA activities are potential challenges for auditor independence.

Further analysis reveals divergent perceptions between Big Four and non-Big Four auditing firms regarding the expenses associated with implementing and developing CA. Big Four firms view these costs as reasonable in the long run, anticipating enhancements in audit quality and cost savings in auditing procedures. Conversely, non-Big Four firms face challenges in maintaining adequate budgets to cover such expenses. Over time, the increasing prevalence of cloud-based software packages may enable non-Big Four companies to overcome the high costs associated with purchasing, developing, and maintaining IT infrastructure.

This study contributes to the existing literature on CA by addressing the research gap for CA in developing countries, which are characterized by socioeconomic factors different from those in developed countries. Additionally, this study is the first to address the connection between CA and independence. These insights can open platforms for further development and debates between researchers over the interplay between CA and the ethical imperatives of auditors in different contexts.

The implications of our study have significant relevance for policymakers and regulators. Although our findings indicate that Egyptian auditors acknowledge the positive impact of CA on audit quality, a notable gap exists in achieving optimal utilization. The absence of clear guidance on CA techniques and procedures, as well as the delineation of roles among various stakeholders, poses a challenge. Policymakers and regulators are urged to establish auditing standards that precisely delineate the responsibilities of external and internal auditors and management in the CA context. In addition, there should be cooperation between policymakers, regulators, and professional bodies in Egypt to create a local framework for continuous auditing practices that consider the resource constraints in the Egyptian context. This can help reduce confusion among auditors about their roles in CA. The government should encourage technology providers to provide more reasonable technology solutions to audit firms to enable them to implement CA successfully. Additionally, policies may need to support the training of auditors and ensure the availability of skilled professionals to overcome challenges associated with CA implementation. In addition, a re-evaluation of the concept of independence in auditing standards is essential, considering the potential threats associated with the broader use of IT auditing, and CA in particular.

The limitations of our study open the door to a set of potential avenues for future research. The study focuses specifically on the Egyptian audit market, and, as such, the findings may have limitations in terms of generalizability to other regions or countries with different regulatory environments, cultural contexts, and technological infrastructure. Therefore, other researchers could investigate the ramifications of CA in a more expansive context, such as countries within the Gulf Cooperation Council (GCC) or the broader Middle East region, to uncover and report additional findings. In addition, the sample size was relatively small, which can affect the generalizability of the findings. Future researchers are invited to replicate this study with larger sample sizes to draw broader conclusions. In addition, it would be intriguing for future researchers to delve into the effects of CA on auditors' professional judgement, consideration of materiality compared to traditional auditing methods, and internal control systems. Further, the study focused only on auditors' perceptions, suggesting an opportunity for future studies to explore the perceptions of management and regulators to broaden our understanding of the topic. Finally, qualitative

research is recommended to fully understand the reasons for the perceptions and attitudes of auditors regarding CA and to try to develop a framework for continuous auditing.

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