ASSESSING THE EFFICIENCY OF THE EXTERNAL AUDITOR IN COMBATING MONEY LAUNDERING IN THE FINANCIAL SECTOR GOVERNANCE

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How to cite this paper: Alnor, N. H. A., Al-Matari, E. M., Al-Bukhrani, M. A., Alhebri, A., Omer, A. M., & Mohammed, O. A. A. (2025). Assessing the efficiency of the external auditor in combating money laundering in the financial sector governance [Special issue]. *Journal of Governance & Regulation, 14*(1), 262–276.
https://doi.org/10.22495/jgrv14i1siart3

ISSN Online: 2306-6784
ISSN Print: 2220-9352

Received: 05.04.2024
Revised: 22.07.2024; 28.08.2024; 29.01.2025
Accepted: 07.02.2025

JEL Classification: G23, M42, M48
DOI: 10.22495/jgrv14i1siart3

Abstract

This study evaluates the efficiency of external auditors in combating money laundering in the Sudanese financial sector. It examines how auditors' capabilities and characteristics influence their effectiveness in anti-money laundering (AML). Quantitative data were collected through a survey of 228 external auditors in Sudan. Partial least squares structural equation modeling (PLS-SEM) was used to analyze the data. Auditors' skills in rigorous financial analysis and investigation significantly improve their AML performance. Additionally, a strong ethical orientation positively affects auditors' effectiveness. However, practical experience did not enhance the detection of money laundering. Most notably, the adoption of advanced technologies and analytics tools had the strongest positive impact. The findings highlight the need for enhanced auditor training, greater investments in regulatory technology (RegTech), increased oversight of ethics, and expanded information-sharing between auditors, regulators, and financial institutions. This study provides unique empirical evidence on leveraging external auditors' capabilities to combat money laundering, specifically within the Sudanese context. The research model demonstrated good explanatory power and predictive accuracy.

Keywords: Anti-Money Laundering, Audit, External Audit, Financial Crime, Forensic Accounting, Regulatory Technology

Authors' individual contribution: Conceptualization — N.H.A.A.; Methodology — E.M.A.-M.; Software — E.M.A.-M.; Validation — E.M.A.-M.; Formal Analysis — M.A.A.-B.; Investigation — A.A. and A.M.O.; Resources — A.A. and O.A.A.M.; Data Curation — N.H.A.A. and E.M.A.-M.; Writing — Original Draft — N.H.A.A. and E.M.A.-M.; Writing — Review & Editing — N.H.A.A., E.M.A.-M., M.A.A.-B., A.A., A.M.O., and O.A.A.M.; Visualization — A.A., A.M.O., and O.A.A.M.; Supervision — E.M.A.-M. and A.A.; Project Administration — E.M.A.-M.; Funding Acquisition — A.A., A.M.O., and O.A.A.M.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

Acknowledgement: The Authors extend their appreciation to the Deanship of Research and Graduate Studies at King Khalid University for funding this work through a large-group research project under Grant No. RGP.2/131/45.

1. INTRODUCTION

The risk of money laundering poses a severe danger to the stability and integrity of the world's financial system (Benzerrouk et al., 2023). Effective money laundering prevention and detection are of the utmost importance in Sudan, as the financial sector is crucial to the nation's economic success (Ofoeda et al., 2022). External auditors play a crucial part in this effort because they act as independent gatekeepers charged with determining whether financial institutions are complying with the Anti-Money Laundering and Countering Financing of Terrorism Act (AML/CFT) and maintaining the financial system's integrity (Sullivan, 2015; Xiao et al., 2020). The financial industry in Sudan has undergone significant changes recently due to political circumstances, economic reforms, increased globalization, and technological advancements, similar to many other financial sectors throughout the world (Suzuki & Uddin, 2016). The fight against money laundering has become more complex and difficult as a result of these changes which happened recently (Soudijn, 2019). As a result, there is more interest in how well external auditors are able to stop this financial crime and increase their qualification to combat all financial crimes (McMahon et al., 2016).

To evaluate the effectiveness of external auditors in the battle against money laundering, this study examined their crucial role in the Sudanese financial industry (Dobrowolski & Sułkowski, 2020). It aims to investigate the difficulties they encounter, the resources and methods they use, and the degree to which they support the sector's resilience against illegal financial activity and reduce its harmful effects on the Sudanese economy (Mohamed, 2018; Onwujekwe et al., 2020). This study aims to offer useful insights for policymakers, financial institutions, regulatory bodies, and external auditors themselves in enhancing their group efforts to enhance commitment and effectiveness in combat money laundering by understanding the current situation and identifying areas for improvement (Mansoor, 2021; Nizovtsev et al., 2022). The evaluation of the effectiveness of external auditors in Sudan's financial and nonfinancial industries in preventing money laundering is important not only for Sudan but also for the larger global conversation on AML/CFT Recommendations (de Koker et al., 2017). It is critical to consider the role of important stakeholders like external auditors in the quest for more effective AML strategies as financial systems continue to change and adapt to new threats and risks (Saeed et al., 2023). By conducting this investigation, we will increase the financial sector of Sudan's resiliency, safeguard its integrity, and eventually support the growth and stability of the nation's economy (Pearce et al., 2017).

This study enhances Sudan's financial sector audit framework by developing standards for assessing money laundering operations and reporting potentially illicit transactions. Based on the results of our research, we strongly recommend that financial institutions regularly perform risk assessments to identify potential vulnerabilities and areas susceptible to money laundering activities. This will facilitate the development of audit methods that align with the specific risks encountered by the Sudanese banking industry. We may assist by advocating for the adoption of specialized training programs for auditors that focus on global AML norms, Sudanese legal obligations, and techniques for detecting money laundering. This would enhance auditors' capacity to detect questionable transactions, notify the Financial Intelligence Units (FIU), and keep them informed about the latest advancements in the field of money laundering. Furthermore, this study bolsters the reliability of auditing procedures by conforming to international AML standards, hence reinforcing AML protocols inside the Sudanese banking sector. This study advocates for the enforcement of rigorous regulatory supervision to ensure auditors are held responsible for any negligence or failure to comply with recognizing potential money laundering activities and reporting suspicious transactions, as outlined in the eighth and final point. Enforcing strict penalties for non-compliance can serve as an effective means of encouraging auditors to adhere to the highest standards of due diligence.

Evaluating the efficacy of external auditors in deterring money laundering in the financial industry is of utmost importance (Ofoeda et al., 2022). The research used a quantitative survey approach to collect data from external auditors in Sudan. It then analyzes the study model, defines the underlying concepts and assumptions, and investigates differences in internal controls and financial accounts (Feng et al., 2015). Evaluating an auditor's proficiency ensures their ability to detect anomalous or questionable financial transactions, which could indicate potential money laundering (Lai et al., 2018).

Furthermore, this study proposes enhancements in auditor training, investments in regulatory technology (RegTech), control of ethics, and sharing of information to strengthen AML initiatives in Sudan. Additionally, it implies the necessity of creating efficient audit frameworks that are based on risk assessment, providing training programs, and establishing collaborative policies. This study employs a quantitative survey technique to examine the factors that influence the effectiveness of AML efforts in Sudan. The analysis is conducted using structural equation modeling (SEM). This paper outlines the approach, presents the results, discusses the implications for theory and practice, acknowledges its shortcomings, and suggests future study options.

The organization of this paper is as follows. Section 2 provides an overview of the pertinent literature. Section 3 examines the technique employed in empirical study on evaluating the effectiveness of external auditors in combatting money laundering within the governance of the financial industry. Section 4 focuses on the data analysis and findings. Section 5 analyzes the findings of the investigation. Finally, Section 6 emphasized the conclusion of the investigation.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

For organizations to identify financial anomalies, external auditors are essential (Noordin et al., 2022). Most businesses are required by law to have external auditors review their financial statements annually. An annual audit's goal is to increase potential users' trust in the final accounts released (Schultz & Tropmann-Frick, 2020). Their main duties include assessing the dependability and correctness of an organization's financial records in order to make sure that the financial statements give a true and fair picture of the company's financial situation (Khikmah et al., 2023; Robinson, 2020). Finding

financial anomalies is an important step in this procedure. By assisting in making sure that companies adhere to pertinent rules and regulations, external auditors play a significant role in the battle against money laundering (Prendi & Murrja, 2023; Dobrowolski & Sułkowski, 2020). There are some strategies that external auditors can use to help combat money laundering. The first is risk assessment, which considers elements including the nature of the company, its clientele, and the areas in which it works to evaluate the risks of money laundering within the firm. They can then create their own auditing processes to deal with these concerns (Naheem, 2019). Second is due diligence, in which auditors examine the source of funds and the intended use of transactions to confirm the validity of institutional business transactions. To confirm that the company's due diligence practices for clients and suppliers are adequate, and in line with AML regulations, they can also examine their effectiveness (Lawrence, 2024). Third, to spot and report suspicious activities, auditors must examine internal controls, including policies and processes (Zakaria et al., 2016). To prevent and identify potential money laundering activities, they can recommend modifications where needed and tighten controls (Singh & Best, 2019). Fourth, every organization needs to keep track of its financial transactions, and auditors can analyze the procedures in place to do so and spot any odd trends that would point to money laundering (Singh & Best, 2019). They can assess how well these procedures work and provide suggestions for changes to guarantee that suspicious activity is found and reported to the FIU (Beebeejaun & Dulloo, 2023). Auditors must also confirm that the company's compliance with pertinent AML rules and regulations can be evaluated by auditors. They can assess organizational policies and processes to ensure that they adhere to the most recent legislative mandates and AML best practices (Dobrowolski & Sułkowski, 2020). Organizations are required by law to disclose suspicious activities to the appropriate authorities, and auditors determine whether the organization is complying with these requirements (Jeppesen, 2019).

Few studies have examined the role of external auditors in combating money laundering (Dobrowolski & Sułkowski, 2020), and we discuss the topics of the current study related to the role of external auditors in combating money laundering.

2.1. Training and qualification of the external auditor and anti-money laundering

Because external auditors are frequently in a unique position to identify suspect actions in the financial records of a business, external auditor training is essential in combating money laundering (Dobrowolski & Sułkowski, 2020). Auditor training provides them with a thorough understanding of various money laundering strategies and tactics (Sullivan, 2015). Using this information, they can see potential red flags during audits (Magro & da Cunha, 2017). Training enables auditors to stay current on the most recent legal requirements and compliance guidelines pertaining to AML controls (Akinteye et al., 2023). With this information, they may ensure that the audited organization abides by all applicable rules and regulations (Abd Rahman et al., 2020). Auditors can have a solid understanding of risk assessment procedures with the right training (Cohen et al., 2017). They can then use this information to assess the likelihood that the organization they audit will engage in money laundering operations (Naheem, 2015). Training helps auditors create specialized audit protocols designed to spot suspected money laundering activities (Dobrowolski & Sułkowski, 2020). Examining financial transactions, performing forensic accounting, and gauging the general integrity of the financial reporting process may be necessary to achieve this goal (Awolowo, 2019). The ability to spot anomalous or suspicious transactions that could be signs of possible money laundering is a skill in which auditors are trained (Norton, 2018). This involves locating transactions that are at odds with the audited entity's typical business operations (Pinto & Morais, 2019). Training programs help keep auditors up-to-date on new developments and growing money laundering techniques (Naheem, 2016b). Using this information, auditors can modify their auditing procedures to successfully counter new and advanced money laundering schemes (Naheem, 2019). Based on this discussion, we can formulate the following hypothesis:

H1: There is a positive relationship between external auditor training and qualification and anti-money laundering.

2.2. Ability to analyze and investigate the external auditor and anti-money laundering

To ensure that organizations are not engaged in illegal financial activities, an external auditor's role in assessing and researching the fight against money laundering might be vital (Isa et al., 2015). The external auditor must be completely familiar with the AML rules and regulations in the countries where the company conducts business (Mousavi et al., 2022). They can identify any inconsistencies or probable infractions during their audit process thanks to this knowledge (Reinecke & Donaghey, 2021). Risk analyses and due diligence procedures can be carried out by external auditors to find probable places where money laundering operations within the business might occur (Naheem, 2015). Examining client interactions, transactions, and the entire corporate environment can be included to identify any questionable activity (Marinkovic & Kalinic, 2017). Auditors can examine financial transactions to look for any strange patterns or behaviors that might indicate possible money laundering (Free & Murphy, 2015). They can spot any irregularities or inconsistencies in financial documents that call for additional inquiry (Brown, 2020). To prevent and identify money laundering operations, it is crucial to assess the efficacy of internal controls (Vijeyan & Rahmat, 2022). Auditors can evaluate whether sufficient internal controls have been set up to reduce the risk of money laundering and guarantee adherence to pertinent rules (Vo, 2020). The following hypothesis can be developed based on prior discussion:

H2: There is a positive relationship between the ability to analyze and investigate the external auditor and anti-money laundering.

2.3. The use of technology and tools by the external auditor in anti-money laundering

With the use of numerous technologies and instruments, external auditors play a significant role in the fight against money laundering (Singh & Best,

2019). External auditors can use several techniques and procedures to successfully spot and stop money laundering operations (Naheem, 2016a). A few of these are external auditors who can evaluate big financial data sets, spot abnormal trends, and spot any suspicious transactions or acts that might point to potential money laundering using sophisticated data analysis technologies (Singh & Lin, 2021). Artificial intelligence (AI) and machine learning algorithms can be used to identify suspected money laundering operations, highlight transactions that differ from normal patterns, and notice anomalous behavior (Garcia-Bedoya et al., 2021). With the development of blockchain technology, auditors can use blockchain analysis tools to monitor and analyze transactions (Dai & Vasarhelyi, 2017). This ensures transparency and makes it possible to spot any illegal activity within the blockchain (Rathee et al., 2020). By utilizing RegTech solutions, auditors can simplify the auditing process, ensure compliance with AML requirements, and more quickly identify any potential infractions (Johansson et al., 2019). Based on the above discussion, we formulated the following hypotheses:

H3: There is a positive relationship between the use of technology and tools by the external auditor and anti-money laundering.

2.4. Ethical behavior and integrity of the external auditor in anti-money laundering

In particular, the work of an external auditor is crucial for preventing money laundering and upholding the integrity of financial reporting (Whisker & Lokanan, 2019). Money laundering is the practice of hiding the source of unlawfully obtained funds, frequently through transfers involving legitimate companies or foreign institutions (Gjoni et al., 2015). To ensure that their evaluation of a company's financial data is impartial and truthful, external auditors must retain their independence and neutrality (Jarah et al., 2022). This is essential for identifying inconsistencies or questionable transactions that could point to money laundering activities (Chen et al., 2018). External auditors must thoroughly understand the legal and regulatory frameworks pertaining to money laundering (Naheem, 2016b). This involves being informed of the numerous laws and rules intended to stop money laundering, as well as the obligations for reporting suspicious activity (Helgesson & Mörth, 2016). Auditor confidentiality and the careful handling of sensitive material are equally important as reporting any questionable activity (Li et al., 2020). This is essential for preserving clients' trust while upholding their legal commitments (Wang et al., 2023). The following hypothesis can be proposed by researchers in light of the above debate:

H4: There is a positive relationship between ethical behavior and integrity of the external auditor and anti-money laundering.

2.5. The external auditor's experience and practical history in anti-money laundering

External auditors frequently receive specific training and certification in various fields, including fraud detection, forensic accounting, and AML compliance (Afriyie et al., 2023). This provides them with the information and resources needed to spot questionable financial activities (Cohen et al., 2017). Experienced auditors are knowledgeable about legal standards, and international organizations such as the Financial Action Task Force (FATF) have been established (Nance, 2018). They can spot any inconsistencies or potential violations during their audits because they are aware of how crucial it is to uphold these standards (Stafford et al., 2018). Experienced auditors are skilled at spotting signs of money laundering, including irregular transactions, intricate ownership structures, high-risk jurisdictions, and mismatches between financial records and real business operations (Tucker, 2022). When conducting audits, they use their practical background and experience to identify these signs (Rivera & Tilcsik, 2016). External auditors with experience in preventing money laundering maintain their knowledge and expertise to stay abreast of criminals' ever-evolving methods (Turki et al., 2020). To stay current with the newest trends and best practices in the area of AML compliance, they attend training, seminars, and conferences (Tsingou, 2018). Based on the discussion above, scholars have formulated the following hypothesis:

H5: There is a positive relationship between the external auditor's experience and practical history and anti-money laundering.

3. RESEARCH METHODOLOGY

3.1. Research design and approach

This study used a quantitative research design and survey methodology to examine the research objectives. A quantitative approach allows for the statistical analysis of measurable data on the variables of interest (Creswell & Creswell, 2017). The survey method enables the collection of data from a sample that can be generalized to a broader population of auditors in Sudan (Fowler, 2013), which facilitates the gathering of responses related to auditors' capabilities, characteristics, and AML performance in an economical manner. Moreover, this study suggests that researchers should gather data by conducting face-to-face interviews with stakeholders at Sudanese banks in order to obtain comprehensive information about the procedures that might effectively mitigate money laundering.

3.2. Population and sampling

The target population comprises external auditors operating in the Sudanese financial sector. A total of 228 auditors participated in the survey conducted for this study. Convenience sampling was used to recruit participants, based on accessibility and availability. Although not random, this approach allowed for timely data collection from a sufficient sample size. The final sample represented diversity across key demographic traits, including gender, age, education, organizational roles, and years of auditing experience. Table 1 presents the respondent profiles, showing the composition of the sample.

3.3. Instrumentation

A structured questionnaire was developed to collect data based on established measures adapted from the prior academic literature. The survey instrument

comprised multiple items measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) related to the following variables:

- Training and qualification of the external auditor (*TAQ*) (Chen et al., 2020);
- Ability to analyze and investigate the external auditor (*AAAI*) (Radu et al., 2019);
- The use of technology and tools by the external auditor (*UTT*) (Oshlyansky et al., 2007);
- Ethical behavior and integrity of the external auditor (*EBAI*) (Drozd et al., 2020);
- The external auditor's experience and practical history (*EAPH*) (Wang et al., 2023);
- Anti-money laundering (*AML*) (Sultan & Mohamed, 2023).

Table 2 in the next section provides descriptive statistics, indicating the means and standard deviations of the measurement items. The questionnaire included demographic questions.

3.4. Data collection procedures

The data were gathered over a two-month period in 2023 using the online survey platform Qualtrics. The survey link was shared with auditors in Sudan through professional associations and individual contacts. The respondents voluntarily participated in the anonymous survey. In total, 228 completed responses were obtained to reach the required sample size.

4. RESEARCH RESULTS

The survey data were analyzed by applying the SEM method known as partial least squares (PLS-SEM) using the SmartPLS software. PLS-SEM was selected due to its ability to handle complex models and non-normal data (Hair et al., 2023). The measurement model was first assessed by examining reliability and validity. Then, the structural model was evaluated to test the hypothesized relationships and research framework. The tables and figures illustrate PLS-SEM outputs. The analysis provides a rigorous examination of quantitative data to address the study's aims.

4.1. Respondent profile

The respondent profile shown in Table 1 indicates diversity across key demographic characteristics, enhancing the representation of the sample. Table 1 indicates that women made up the majority of respondents (79.82%), reflecting the predominantly female composition of the auditing profession in Sudan. The most common age group was 36–45 years old (43.86%), indicative of experienced mid-career professionals. In terms of qualifications, 63.60% held a bachelor's degree, while 22.81% and 11.40% attained master's and doctoral degrees, respectively, denoting a high educational background overall. Nearly half (49.56%) majored in accounting, appropriate given its relevance to auditing roles. The sample comprised mainly auditors (57.02%) and accountants (23.25%) across organizational levels, with department managers constituting 7.02%. This provides perspectives on both frontline auditing and supervisory levels. Regarding experience, 37.72% had 5–10 years of experience, followed by 33.77% with less than 5 years, showing a balanced mix of tenured and newer professionals. Only 6.58% had more with over 15 years in the field.

Table 1. Respondents' demographic variables

Category	*Frequency*	*Percentage (%)*
Panel 1: Gender		
Male	46	20.18
Female	182	79.82
Total	228	100.00
Panel 2: Age		
Above 60 years old	22.00	9.65
46–60 years old	55.00	24.12
36–45 years old	100.00	43.86
25–35 years old	49.00	21.49
Less than 25 years old	2	0.877193
Total	228	100
Panel 3: Qualification		
PhD	26	11.40
Master	52	22.81
Postgraduate Diploma	4	1.75
Bachelor	145	63.60
Diploma	1	0.44
Total	228	100
Panel 4: Professional qualification		
Other	7	3.07
Nothing	201	88.16
American fellowship	8	3.51
British fellowship	7	3.07
Arab fellowship	5	2.19
Total	228	100
Panel 5: Major		
Other	35	15.35
Business administration	27	11.84
Information technology	12	5.26
Banking sciences	41	17.98
Accounting	113	49.56
Total	228	100
Panel 6: Gob level		
Other	29	12.72
Department manager	16	7.02
Auditor	130	57.02
Accountant	53	23.25
Total	228	100
Panel 7: Experience		
Above 20 years	5	2.19
16–20 years	10	4.39
11–15 years	50	21.93
5–10 years	86	37.72
Less than 5 years	77	33.77
Total	228	100

In summary, the sample covers diverse and appropriate respondent characteristics to provide credible insights into auditing practices for *AML* in Sudan. The profile suggests that perspectives were captured by experienced auditing specialists as well as relatively new entrants to the profession.

4.2. Descriptive statistics

In this section, this study provided descriptive statistics as shown in Table 2.

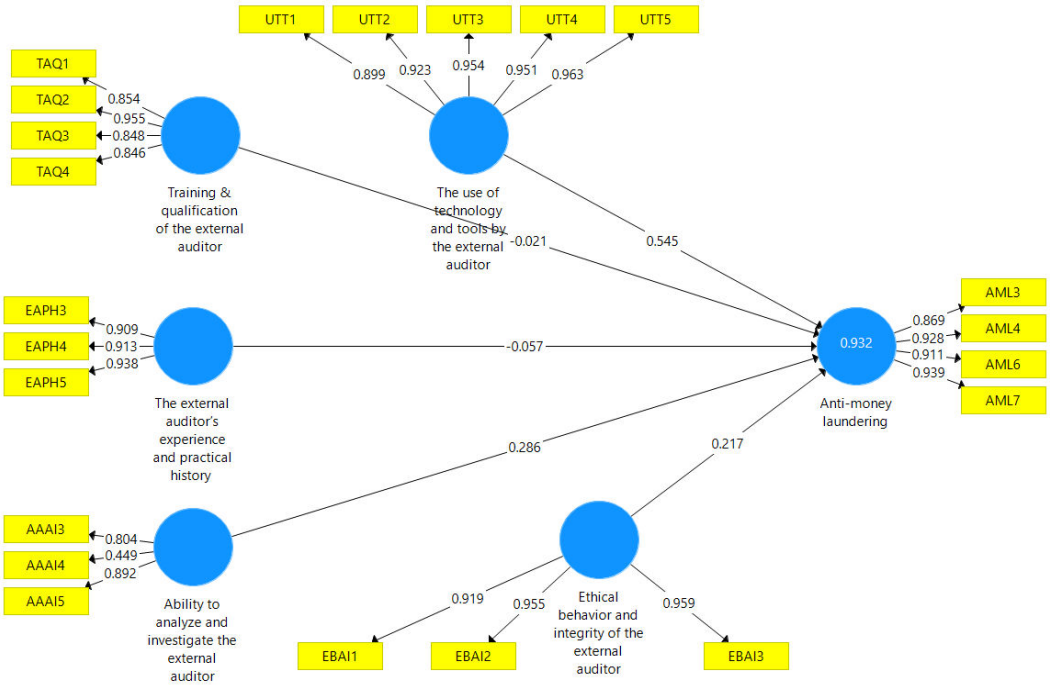
Table 2. Descriptive statistics

Variables	*Questions*	*Indicators*	*Mean*	*Std. dev.*
TAQ	Auditors have the knowledge and skills necessary for the auditing profession.	*TAQ1*	3.94	1.04
	There are modern training methods to develop auditors' skills.	*TAQ2*	3.96	0.97
	The necessary resources are available to help enhance the training and qualification of external auditors.	*TAQ3*	4.08	0.95
	There is a periodic evaluation of the performance of external auditors to ensure their continued development.	*TAQ4*	3.97	1.03
	Average mean			3.9875
	Average Std. deviation			0.9975
AAAI	The auditor is competent in his ability to analyze information and effectively identify relevant issues.	*AAAI3*	3.87	1.21
	The external auditor uses data analysis tools to identify and evaluate financial risks during the audit process.	*AAAI4*	3.96	1.08
	The auditor consistently analyzes information effectively, detects important issues, and provides reliable assessments.	*AAAI5*	4.02	1.18
	Average mean			3.95
	Average std. deviation			1.1566667
UTT	The external auditor uses automated audit programs effectively.	*UTT1*	3.98	1.18
	Technology-based audit tools used by the external auditor enhance the accuracy of financial statement audits.	*UTT2*	3.88	1.22
	The external auditor effectively integrates artificial intelligence and machine learning technologies to improve the quality of the audit.	*UTT3*	3.8	1.28
	The external auditor uses advanced cybersecurity tools and practices to protect sensitive client data during the audit process.	*UTT4*	3.9	1.22
	The external auditor communicates effectively with clients through secure digital channels to exchange audit-related information.	*UTT5*	3.89	1.25
	Average mean			3.89
	Average std. deviation			1.23
EBAI	The external auditor consistently demonstrates honesty and transparency in his dealings with clients.	*EBAI1*	3.87	1.29
	The external auditor has a high level of professional ethics and adheres to relevant auditing standards and regulations.	*EBAI2*	3.71	1.29
	The external auditor demonstrates a commitment to objectivity and independence in his audits.	*EBAI3*	3.7	1.33
	Average mean			3.76
	Average std. deviation			1.3033333
EAPH	There is a correspondence between the history of the external auditor's work and the complexity of operations in organizations.	*EAPH3*	4.08	0.98
	The external auditor is able to identify and address financial risks during audits.	*EAPH4*	4.09	1.08
	The external auditor's work history reflects a track record of detecting irregularities or fraud.	*EAPH5*	3.97	1.03
	Average mean			4.046667
	Average std. deviation			1.03
AML	Other controls for establishing business relationships (such as blocking numbered accounts, anonymous accounts, or dealing with prohibited persons).	*AML3*	4.12	1.13
	Situations requiring special procedures (influential persons, correspondent banking relationships, electronic transfers, and new technologies).	*AML4*	4	1.19
	Notification of suspicious transactions	*AML6*	3.68	1.32
	Internal control system	*AML7*	3.76	1.25
	Average mean			3.89
	Average std. deviation			1.2225

4.3. Structure equation modeling results

In this section, we provided the measurement/outer model, this framework encompasses key performance indicators (KPIs), measurement methods, and an external model that establishes the connections between various factors, including the effectiveness of the external auditor in reducing money laundering risks, regulatory compliance, and governance quality as shown in Figure 1.

Figure 1. The measurement/outer model



4.3.1. Convergent validity

Convergent validity was examined by analyzing the average variance extracted (AVE), composite reliability (CR), and outer loadings for each construct in the measurement model (see Table 3). First, the outer loadings of the measurement items were assessed. High outer loadings on a construct provide evidence that the indicators effectively capture the constructs they are assigned to measure. Most indicators had strong outer loadings exceeding 0.7, thus meeting the recommended threshold (Hair et al., 2017). This was demonstrated across items measuring *AML* (0.869–0.939), *EBAI* (0.909–0.938), *EAPH* (0.919–0.959), *UTT* (0.899–0.963), and *TAQ* (0.854–0.955). However, one indicator measuring the ability to analyze and investigate *AAAI4* had a noticeably lower outer loading of 0.449 compared to the others (0.804–0.892). This suggests that *AAAI4* may not capture its intended construct as effectively as other items. Next, the CR values were inspected to evaluate the internal consistency between the indicators of each construct (see Table 2). The CRs ranged from 0.772 to 0.974, surpassing the recommended threshold of 0.7 (Hair et al., 2017). This demonstrates the adequate reliability between the measures for each construct. Additionally, the AVE, which reflects the variance captured by a construct versus the measurement error, was assessed. AVE values above 0.5 indicate sufficient construct convergence (Hair et al., 2017). All constructs met this standard, with AVEs ranging from 0.548 to 0.892. However, the ability to analyze and investigate had the lowest AVE at 0.548, slightly exceeding the threshold.

Overall, the results provide evidence of adequate convergent validity, as most items loaded highly on their constructs, CR exceeded 0.7, and AVE was greater than 0.5. The exception was the *AAAI4* indicator, which raises concerns about its effectiveness in measuring the ability to analyze and investigate. While *AAAI4*'s removal had a minimal impact on reliability and AVE, its low loading warrants attention in future research. Replication of this weak loading justifies the deletion or refinement of this particular item. In summary, while convergent validity is demonstrated, continued examination of *AAAI4* is recommended to improve the measurement of its associated construct; however, indicators that did not fulfill the threshold of outer loading were excluded.

Table 3. Convergent validity (Part 1)

Construct	*Indicators*	*Outer loading*	*Cronbach's alpha*	*CR*	*AVE*
AAAI	*AAAI3*	0.804	0.641	0.772	0.548
	AAAI4	0.449			
	AAAI5	0.892			
AML	*AML3*	0.869	0.932	0.952	0.832
	AML4	0.928			
	AML6	0.911			
	AML7	0.939			
EBAI	*EAPH3*	0.909	0.939	0.961	0.892
	EAPH4	0.913			
	EAPH5	0.938			

Table 3. Convergent validity (Part 2)

Construct	*Indicators*	*Outer loading*	*Cronbach's alpha*	*CR*	*AVE*
EAPH	*EBAI1*	0.919	0.911	0.943	0.846
	EBAI2	0.955			
	EBAI3	0.959			
TAQ	*TAQ1*	0.854	0.902	0.930	0.770
	TAQ2	0.955			
	TAQ3	0.848			
	TAQ4	0.846			
UTT	*UTT1*	0.899	0.966	0.974	0.881
	UTT2	0.923			
	UTT3	0.954			
	UTT4	0.951			
	UTT5	0.963			

4.3.2. Discriminant validity

The degree to which a construct is genuinely different from other constructs in the model is known as the discriminant validity (Alnor et al., 2024). Three methods were used to assess discriminant validity in this study: 1) cross-loading, 2) the heterotrait-monotrait (HTMT) ratio, and 3) the Fornell-Larcker criterion. The Fornell-Larcker criterion (see Table 4) compares the square root of the AVE for each construct to assess discriminant validity versus its correlations with other constructs. As seen in Table 4, the square root of AVE (shown on the diagonal in bold) is greater than the inter-construct correlations for all constructs, with one exception. The AVE square root for the ability to analyze and investigate (0.74) was lower than its highest correlation of 0.814 with *AML* and *AML* with *UUT*. This indicates potential issues with the discriminant validity between these two constructs. For the remaining constructs, the AVE square roots were greater than the correlations, thus demonstrating discriminant validity.

Table 4. Fonrell-Larcker criterion

Construct	*AAAI*	*AML*	*EAPH*	*EBAI*	*UTT*	*TAQ*
AAAI	0.740					
AML	0.814	0.912				
EAPH	0.709	0.912	0.944			
EBAI	0.450	0.202	0.189	0.920		
UTT	0.749	0.947	0.930	0.193	0.938	
TAQ	0.371	0.150	0.153	0.740	0.136	0.877

The HTMT ratios were calculated, as shown in Table 5. HTMT values below 0.85 or 0.90 indicate constructs are empirically different (Hamza et al., 2024). The HTMT values ranged from 0.138 to 0.996 in this study, with most values falling below common cut-off values. This further supports the fact that the constructs exhibit sufficient discrimination. However, the two HTMT values slightly exceeded the threshold, specifically the ratios between *AML* and *EAPH* (0.973), and *AML* and *UTT* (0.996). While this raises potential concerns about discriminant validity, HTMT inferences should consider theoretical and measurement aspects rather than applying an absolute cutoff. Overall, most of the HTMT results satisfied the recommended standards.

Table 5. The heterotrait-monotrait ratios

Construct	*AAAI*	*AML*	*EAPH*	*EBAI*	*UTT*	*TAQ*
AAAI						
AML	0.865					
EAPH	0.759	0.973				
EBAI	0.842	0.211	0.201			
UTT	0.783	0.996	0.977	0.200		
TAQ	0.733	0.149	0.156	0.822	0.138	

Finally, as shown in Table 6, the examination of cross-loadings provides additional evidence of discriminant validity. Each indicator loads more strongly on its own construct than on other constructs in the model. For instance, the *AAAI3* item loads the highest on the ability to analyze and investigate (0.804) compared to cross-loadings below 0.557 on other constructs. This pattern holds across most indicators, further demonstrating that the measures effectively differentiate between model constructs. It should be noted that indicators that did not fulfill the cross-loading criteria were excluded.

In summary, assessment via the Fornell-Larcker criterion, HTMT ratios, and cross-loadings provide support for the discriminant validity of the constructs in the measurement model. The constructs exhibited sufficient distinctness from one another based on the analyses performed.

Table 6. Cross loading

Indicators	*AAAI*	*AML*	*EAPH*	*EBAI*	*TAQ*	*UTT*
AAAI3	0.804	0.557	0.463	0.526	0.418	0.541
AAAI4	0.449	0.141	0.799	0.129	0.710	0.125
AAAI5	0.892	0.830	0.232	0.695	0.158	0.745
AML3	0.824	0.869	0.192	0.725	0.145	0.777
AML4	0.736	0.928	0.163	0.838	0.096	0.923
AML6	0.675	0.911	0.184	0.888	0.164	0.880
AML7	0.743	0.939	0.201	0.872	0.145	0.870
EAPH3	0.355	0.128	0.909	0.161	0.669	0.141
EAPH4	0.392	0.191	0.913	0.149	0.602	0.173
EAPH5	0.471	0.217	0.938	0.205	0.760	0.204
EBAI1	0.660	0.854	0.186	0.919	0.101	0.902
EBAI2	0.651	0.851	0.157	0.955	0.142	0.858
EBAI3	0.697	0.879	0.193	0.959	0.189	0.875
TAQ1	0.270	0.110	0.610	0.081	0.854	0.086
TAQ2	0.381	0.186	0.686	0.184	0.955	0.166
TAQ3	0.299	0.073	0.713	0.119	0.848	0.116
TAQ4	0.327	0.111	0.626	0.121	0.846	0.085
UTT1	0.692	0.885	0.107	0.816	0.083	0.899
UTT2	0.692	0.863	0.187	0.883	0.146	0.923
UTT3	0.690	0.897	0.197	0.902	0.158	0.954
UTT4	0.731	0.913	0.207	0.873	0.112	0.951
UTT5	0.708	0.883	0.207	0.889	0.141	0.963

4.4. Structural model (inner model) and hypotheses testing

The hypothesized relationships in the research model were examined by analyzing the structural model results (see Table 7 and Figure 2). Table 5 presents the path coefficients and their significance levels. An assessment of the structural model and hypothesized relationships reveals several significant effects of external auditor characteristics on *AML* efforts. The exogenous constructs collectively explained a substantial 93% of the variance in the endogenous *AML* construct, as evidenced by the R^2 value of 0.930 (see Figure 1).

Specifically, the ability to rigorously analyze and investigate financial transactions has a significantly positive influence on *AML* ($\beta = 0.286$, $p < 0.01$), providing support for *H1*. This indicates that auditors who are adept at forensic analysis and evaluation of anomalous transactions can better detect potential money laundering activities. Furthermore, auditors' ethical behavior and integrity, as exemplified by objectivity and honesty, also positively affect *AML* ($\beta = 0.217$, $p < 0.05$), thereby confirming *H2*. Auditors with high ethical standards are less likely to abet illegal dealings and more inclined to report suspicious cases.

On the contrary, *H3*, which predicted that extensive practical experience would improve auditors' *AML* performance, is not supported, as the path coefficient is non-significant ($p > 0.05$). This suggests that experience or length of service in the auditing field alone does not always translate into improved detection of money laundering activities. Likewise, *H5* was not corroborated, as intensive training and professional qualifications did not significantly impact *AML* ($p > 0.05$). This indicates that current training programs may be inadequate for imparting the specialized knowledge required for *AML* monitoring.

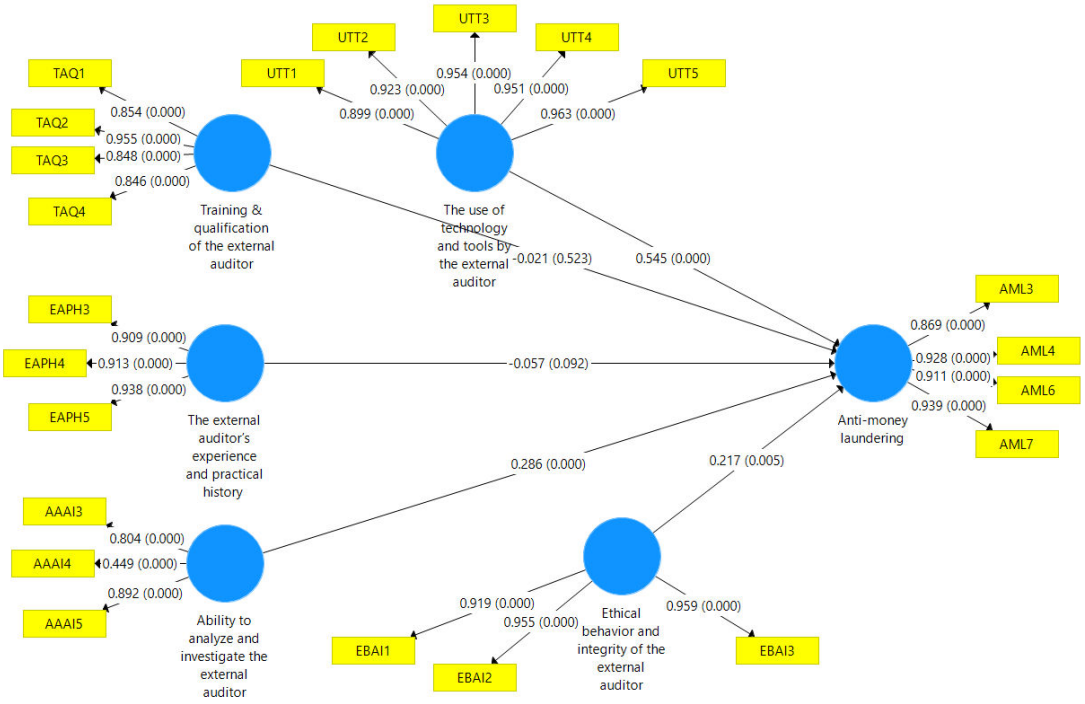
Notably, auditors' adoption of technology and digital tools has the strongest positive effect on *AML* ($\beta = 0.545$, $p < 0.01$), confirming *H4*. The use of automated transaction monitoring systems and AI can bolster *AML* capabilities far beyond human capacity alone. Overall, rigorous analysis skills, high ethical orientation, and technology usage contribute significantly to auditors' effectiveness in *AML* efforts within the structural model.

Table 7. Structural model path coefficients

Hypotheses	*β*	*SE*	*t-statistic*	*p-values*	*CI*	
					2.5%	*97.5%*
H1: AAAI → AML	**0.286**	**0.034**	**8.356**	**0.000****	0.217	0.353
H2: EBAI → AML	**0.217**	**0.078**	**2.777**	**0.005***	0.056	0.360
H3: EAPH → AML	-0.057	0.034	1.679	0.093	-0.120	0.012
H4: UTT → AML	**0.545**	**0.083**	**6.550**	**0.000****	0.395	0.717
H5: TAQ → AML	-0.021	0.033	0.641	0.521	-0.084	0.049

*Note: SE = standard error, CI = confidence interval. * Relationship is significant at p < 0.01, ** relationship is significant at p < 0.05.*

Figure 2. Structural model path coefficients



4.4.1. Predictive relevance of the model

The in-sample predictive power of the research model was assessed using a PLS prediction procedure. The key statistical indices of predictive accuracy are the root mean square error (RMSE), mean absolute error (MAE), and Q^2 value representing the predictive sample reuse technique (see Table 8).

As evident in Table 8, the Q^2 value for the endogenous construct of *AML* is a substantial 0.927, well above the 0 threshold recommended by Hair et al. (2017). This indicates that the model has excellent predictive relevance for *AML*. The RMSE value of 0.273 and MAE of 0.184 were satisfactorily low, further underscoring the model's predictive precision. Additionally, the *AML* construct exhibited very high in-sample explained variance measures with an R^2 of 0.932 and an adjusted R^2 of 0.930. This signifies that the exogenous variables related to external auditor skills and technology usage collectively demonstrate great predictive power in explaining variances in *AML* detection capabilities.

In conclusion, the PLS prediction results provide convincing evidence that the research model has robust in-sample predictive accuracy. The model also demonstrates the potential for predicting *AML* performance out-of-sample based on auditor-related antecedents.

Table 8. PLS predict: Prediction summary and R-values

Endogenous construct	*RMSE*	*MAE*	*Q^2_predict*	*R-square*	*R-square adjusted*
AML	0.273	0.184	0.927	0.932	0.930

4.4.2. Goodness-of-fit of the model

The goodness-of-fit (GoF) of the overall research model was assessed using predictive validation measures of cross-validated redundancy and communality. As shown in Table 8, the redundant Q^2 value of the endogenous construct of *AML* is 0.77, and communal Q^2 was 0.70. Given that both indices are greater than zero, as recommended by Hair et al. (2017), this confirms the model's predictive relevance for the *AML* construct. Additionally, the exogenous constructs demonstrate satisfactory predictive validity, with cross-validated communalities ranging from 0.19 to 0.81. The ability to analyze the construct has the lowest Q^2, presenting an opportunity to potentially enhance its measurement model.

Overall, the adequate redundancy and communality Q^2 scores for both endogenous and exogenous constructs signify that the research model exhibits good predictive power. The model demonstrated satisfactory global goodness-of-fit, confirming its ability to make statistically valid predictions of *AML* performance based on external auditor-related antecedents. Minor refinements to exogenous constructs can further improve the model's overall fit.

Table 9. Goodness-of-fit

Constructs	Construct cross-validated redundancy			Construct cross-validated communality		
	SSO	SSE	Q^2 (= 1 - SSE/SSO)	SSO	SSE	Q^2 (= 1 - SSE/SSO)
AAAI	684.00	684.00		684.00	554.88	0.19
AML	912.00	212.45	0.77	912.00	273.63	0.70
EAPH	684.00	684.00		684.00	184.35	0.73
EBAI	684.00	684.00		684.00	244.11	0.64
UTT	1140.00	1140.00		1140.00	220.57	0.81
TAQ	912.00	912.00		912.00	354.86	0.61

Note: SSO — sum of squares of observations, SSE — sum of squares of prediction errors.

5. DISCUSSION

The findings from this study provide valuable insights into the role of external auditors in combating money laundering in the Sudanese financial sector. Overall, the results align with and build upon previous research on AML efforts in accounting and auditing.

Consistent with previous studies (Dobrowolski & Sułkowski, 2020; Isa et al., 2015), our findings confirm that auditors' skills in rigorous financial analysis and investigation are critical for detecting potential money laundering activities. The significant positive relationship between analysis/investigation abilities and AML performance underscores auditors' vital roles as gatekeepers in assessing transactions for anomalies. As suggested by prior research, forensic accounting skills enable auditors to identify red flags and suspicious behaviors that could indicate money laundering (Awolowo, 2019; Marinkovic & Kalinic, 2017). Our study reaffirms the importance of honing auditors' technical analytical capabilities as a key antecedent to effective AML oversight.

We also find that auditors' ethical integrity promotes AML efforts, consistent with Whisker and Lokanan's (2019) arguments on the importance of objectivity and honesty. By retaining independence and upholding reporting duties, ethical auditors act as crucial deterrents to illegal financial activities. However, contrary to expectations, our findings indicate that experience was not a significant driver of money laundering detection. This corroborates studies by Norton (2018) and Dobrowolski and Sułkowski (2020) who find that seasoned auditors do not necessarily excel at identifying laundering schemes. Ongoing training may be more critical than tenure alone in building specialized expertise.

Notably, our research highlights that the adoption of advanced analytics and technology offers the greatest boost to AML capabilities. The strong positive link between digital tools and money laundering prevention aligns with evidence of the merits of AI and machine learning for combating financial crimes (Garcia-Bedoya et al., 2021). As Singh and Best (2019) contend, automated monitoring systems enable the analysis of massive datasets to uncover anomalies and suspicious patterns much more effectively than human auditors alone. Our findings provide unique empirical evidence of the value of emerging RegTech solutions, particularly in the Sudanese context.

Some limitations of this study provide avenues for future research. Our data were collected solely from external auditors; therefore, integrating perspectives from regulatory agencies and financial institutions could offer more rounded insights. A qualitative approach to interviewing key stakeholders may reveal a deeper context of AML dynamics. Additionally, it would be beneficial to incorporate objective performance metrics, such as the number of flagged suspicious transactions, to complement self-reported data. Nonetheless, this study makes notable contributions to understanding external auditors' critical role in combating money laundering and safeguarding the integrity of Sudan's financial system.

6. CONCLUSION

Money laundering is a serious threat to economic stability and growth in Sudan. As independent gatekeepers of the financial system, external auditors play a vital role in detecting and preventing money laundering. This study makes an important contribution by empirically examining how auditors' capabilities and characteristics enable AML efforts in the Sudanese context. The findings confirm that auditors' proficiency in rigorous analysis of financial transactions is crucial for identifying red flags and anomalies that may indicate money laundering schemes. Additionally, a strong ethical orientation marked by objectivity and integrity positively influences auditors' effectiveness in combating illegal activities. However, contrary to expectations, we find that years of experience do not enhance AML performance, suggesting that specialized training is more impactful than tenure alone. Notably, the adoption of technology and analytics tools emerged as the most influential factor in predicting auditors' success in detecting money laundering. Harnessing AI, machine learning, and blockchain analysis offer tremendous potential for monitoring massive datasets, uncovering hidden patterns, and automating compliance.

This study provides an empirical basis for enhancing AML policies and practices within Sudanese financial and auditing professions. The research model explains a substantial portion of the variance in money laundering prevention outcomes, thereby demonstrating its practical utility. Specific recommendations include ramping up technology usage, focusing on advanced forensic skills, and instilling robust ethical values. Better leveraging of external auditors' analytical capabilities and emerging RegTech can significantly bolster Sudan's resilience against money laundering. The integrity of the financial system can be upheld through continuous vigilance and coordinated efforts from key stakeholders. Further research should incorporate objective performance metrics and qualitative insights from regulators, banks, and auditors. As money laundering techniques grow increasingly complex amidst globalized finance, sustained effectiveness requires regular evaluation and adaptation by actors across the financial ecosystem. This study contributes valuable knowledge to policymakers, practitioners, and researchers for strengthening AML strategies.

This study provides several crucial implications for policymakers, regulatory bodies, financial institutions, auditing professionals, and other stakeholders aimed at combating money laundering

in Sudan. These findings highlight the need for enhanced training focused on building advanced analytical skills for detecting financial anomalies and money laundering techniques. Tailored educational programs that integrate the latest methods in forensic accounting, AI, and blockchain analysis would significantly strengthen auditors' capabilities (van Wegberg et al., 2018). Greater investments should be made in emerging RegTech solutions to automate the monitoring, analysis, and reporting of suspicious transactions. As evidenced in this study, technology adoption has the greatest impact on improving AML outcomes. Regulatory authorities must increase the oversight of auditors' ethical behavior to ensure their integrity as gatekeepers of the financial system. Enforcing standards of independence, objectivity, and transparency is essential.

Policy directives and institutional incentives should aim to expand information-sharing and collaborative coordination between external auditors, regulatory bodies, law enforcement agencies, and financial institutions. Breaking silos can enhance system-wide AML vigilance. Regular evaluation of AML policies, controls, and auditor effectiveness can help identify areas for ongoing enhancement. Our study provides an assessment model that can be applied across Sudanese banks and adapted to new risks. In summary, leveraging auditors' analytical skills and technology while upholding strong ethics and open coordination would significantly advance Sudan's fight against money laundering. This study provides data-driven insights to guide multipronged reforms for greater financial transparency and stability.

Despite providing valuable insights, this study has some limitations that point to directions for future research. First, data were collected solely from external auditors using a survey methodology. Incorporating perspectives from regulatory agencies, financial institutions, and law enforcement could provide a more holistic understanding of AML dynamics. Interviews or focus groups may reveal richer qualitative contexts. Second, the study relied on auditors' self-reported assessments of their capabilities and their AML performance. Collecting objective performance data, such as the number of suspicious activity reports filed, complements these perceptual measures. Third, the sample is limited to auditors operating in Sudan. Further research should test the model in other developing country contexts to evaluate its generalizability across diverse legal and socioeconomic environments. Fourth, this study employed cross-sectional data, providing only a snapshot of one point in time. Longitudinal designs tracking auditors over multiple years can illuminate changes and improvements in AML efforts. Finally, further exploration of non-significant relationships may be warranted, such as examining why practical experience does not enhance money laundering detection, as hypothesized. Qualitative approaches can reveal the underlying reasons for these findings. Future studies addressing these limitations will enrich our understanding of auditors' AML roles. Integrating objective performance metrics, the perspectives of multiple stakeholders, and longitudinal data across diverse contexts will be fruitful. As money laundering threats persist and evolve amidst globalized financial systems, the ongoing evaluation of detection strategies is essential for supporting policy reforms. This study provides an initial empirical foundation and model for guiding future research.

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