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RESEARCH ARTICLE

The Impact of Forensic Accounting on the Effectiveness of Fraud Detection in Private-Sector Banking and Merchandising Companies: Evidence From Sulaymaniyah City, Kurdistan Region, Iraq

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Abstract

This study examines the impact of forensic accounting techniques, challenges, and accountants' skills on fraud detection effectiveness in the private sector of Sulaymaniyah City, Kurdistan Region of Iraq. The study employed a quantitative research design, with preliminary semi-structured interviews conducted to inform questionnaire development. In the qualitative phase, purposive sampling was used to interview eight forensic accountants with experience handling multiple fraud cases in Sulaymaniyah. Insights from these interviews guided the creation of a structured questionnaire, which was subsequently distributed to Seventy-four accounting professionals from private banks and merchandising firms for the main data collection. Data were analysed using SPSS Statistics 23, applying Cronbach's alpha to assess reliability, factor loading to validate constructs, and linear regression to test the hypotheses. The results showed that forensic accounting techniques, challenges, and professional skills each had a statistically significant positive effect on fraud detection effectiveness ($R^2 = 0.646$, $*p < .001$). Among these predictors, techniques had the strongest influence ($\beta = .424$), followed by challenges ($\beta = .270$) and skills ($\beta = 0.226$). The positive effect of challenges suggests that systemic barriers may prompt organizations to strengthen internal controls and adopt adaptive practices. The study underscores the need for structured forensic procedures, ongoing skill development, and context-specific approaches to strengthen fraud detection in transitional economies. These findings contribute to the limited literature on forensic accounting in the Kurdistan Region and underscore the need for future research on integrating advanced digital forensic tools alongside traditional practices to strengthen financial system resilience.

Keywords: Forensic accounting, Fraud detection effectiveness, Forensic accounting techniques, Mixed-methods research, Professional skills, Organizational challenges

1. Introduction

Financial fraud is still a serious challenge for the private sector around the globe, with embezzlement, often by employees, fraudulent reporting, and asset misappropriation being some of the primary forms of financial fraud. (Currall & Epstein, 2003) refers to the practice of fraud, which not only causes financial losses but also creates a breach of trust, lowers investor confidence, and disrupts organizational synergy. Because of the financial complexity of many industries and the continuous development of tech-

nology, Richard J. Bolton shows Technology has also introduced new opportunities for criminals to engage in fraud. the other hand, digitalization, localizing salaries, and a lack of citizen awareness in dealing with the bank and the payment from the electronic system can lead to fraud by cheaters who work from different sectors. (Oti-Akenteng et al., 2025) stated that digitalization in government systems involves the use of digital technologies in public administration to improve efficiency, ensure transparency, and strengthen accountability. (Celestin & Vanitha, 2019) believes that the methods of traditional auditing are

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often ineffective systems in fraud detection or fraud prevention, and are especially ineffective in industries with a greater risk of fraud, such as banking and merchandising. Although the private sector is developing fast in the Kurdistan Region of Iraq, including Sulaymaniyah City, most of the organizations currently are suffering institutional problems like weak internal control, lack of transparency and changes of laws and legal differences between Iraq and Kurdistan region every time. Weak internal controls may result in legal violations, increased risk of fraud, and a lack of transparency. These gaps, therefore, produce vulnerabilities where fraud may be perpetrated either undetected or unmitigated. This means that forensic accounting is one of the leading tools to combat these risks. Forensic accounting extends beyond the traditional aspects of accounting. For forensic accounting, this can best be utilized in the banking and merchandising companies — where the quantum of data on financial transactions is enormous and the increase in chances of fraud — forensic accounting supports internal control by identifying weaknesses, preventing fraud, and recommending improvements (Basannang et al., 2024). Nevertheless, forensic accounting can be effective if utilized properly, even as the techniques employed, the challenges posed, and the qualifications of the forensic accountant vary greatly. Given this, investigating these elements is important if forensic practices are to assist in high-quality fraud detection in the context of private sector practices in Sulaymaniyah. Fraud detection may be affected by some key factors. The depth and accuracy of investigations are dependent on the multi-level technique applied by forensic accountants. Detection impossible. Additionally, the forensic accountant's professional skills may also represent an opportunity to better identify and address complex fraud cases Timothy A. The private sector (especially banking and trading companies) has grown in recent years in Sulaymaniyah, a major economic center in the Iraqi Kurdistan Region. These industries process significant amounts of financial transactions and assets and thus are particularly susceptible to fraud. Although these sectors are critical to the economy (Pranta et al., 2025). The entire region has a lot of organizations that operate with weak internal controls, little oversight, and few professional accountants, making them inherently vulnerable to weak financial governance and undetected fraud. Meanwhile, the ambitions of the Iraqi government to localize the salaries for employees through the local ATM and digital channels have brought in extra operational and administrative loads over the private banks and merchandising companies. (Adejumo & Ogburie, 2025) increasing the role of forensic accounting can help alleviate these risks

by bolstering transparency, trust, and the integrity of the financial system.

Although forensic accounting has grown more and more important, there is still little empirical data on the techniques, challenges, and skills associated with fraud detection. This study focuses at how they affect the efficacy of forensic accounting in Sulaymaniyah City's private banking and retail sectors.

This study aims to examine the relationship between key elements of forensic accounting and fraud detection efficiency in the private sector. Specifically, it seeks to assess the impact of forensic accounting techniques on fraud detection efficiency in private sector banks and merchandising firms, analyze the effect of challenges faced by forensic accountants on fraud detection, and test the influence of forensic accountants' skills on improving fraud detection outcomes.

This research addresses how forensic accounting techniques affect the effectiveness of fraud detection in banking and merchandising companies, the main challenges faced by forensic accountants in detecting fraud, the extent to which the skills of forensic accountants impact the effectiveness of fraud detection, and how forensic accounting practices can be improved to enhance the early detection of fraud in Sulaymaniyah's private sector.

This research investigates the forensic accounting factors, challenges, and competencies associated with fraud detection in private banking and merchandising companies in the Sulaymaniyah, Kurdistan Region. Based on one research city and one sample, the results help highlights fraudulent behavior and forensic accounting in similar economic environments and are a rare contribution to the literature in developing and transitional economies.

2. Literature review and hypothesis development

2.1. *Forensic accounting: Concept, scope, and relevance*

Forensic accounting is the combination of accounting, auditing, forensic skills, and criminology to find, identify, and even prevent fraudulent behavior. (Gabielli et al., 2024) drawing on reports from the Association of Certified Fraud Examiners (ACFE), organisations lose more than 5% of their annual revenues to fraud, with most schemes remaining undetected for approximately 12 months. These findings highlight the growing global importance of forensic accounting in strengthening transparency and accountability. (Idrus et al., 2024) emphasize that effective fraud prevention requires both a solid

theoretical foundation and well-developed forensic systems, particularly within private institutions. While forensic accounting practices have expanded globally, their adoption in Iraq and the Kurdistan Region exists but remains limited, with some private banks and merchandising firms applying investigative techniques and professional skills to detect and prevent fraud. Consequently, forensic accounting is especially relevant in emerging economies, where financial fraud poses significant risks to organisational sustainability.

2.2. *Fraud detection effectiveness: Definitions, measures, and indicators.*

Fraud detection effectiveness refers to an organization's ability to identify and respond to fraudulent activities accurately and in a timely manner. Common performance indicators include detection rate, false positive rate, coverage, efficiency, and monetary recovery. Routine Activity Theory explains that fraud occurs when motivated offenders encounter suitable targets without capable guardians, where forensic accountants function as monitoring agents that reduce fraud opportunities (Leukfeldt & Yar, 2016). Agency Theory similarly links fraud to conflicts between principals and agents within organizations. Supporting empirical evidence shows that approximately one-third of companies worldwide experience fraud, particularly within accounting, sales, and management functions, highlighting the need for specialized forensic expertise alongside internal control systems.

2.3. *Forensic accounting techniques and fraud detection*

Forensic accounting employs investigative techniques such as financial statement analysis, data analytics, digital forensics, document examination, and specialized audit procedures. (Schuchter & Levi, 2016), explain that fraud arises from pressure, opportunity, and rationalization, highlighting the need for systematic investigative tools. (Singleton & T., 2020) notes that effective monitoring and investigative techniques enable forensic accountants to anticipate fraud risks. Recent studies demonstrate that advanced technologies such as big data analytics and AI-supported tools significantly enhance fraud detection capabilities. However, in regions such as Kurdistan, forensic practices remain largely dependent on traditional manual auditing due to technological and resource limitations.

Empirical studies consistently demonstrate the effectiveness of these techniques in fraud detection. (Basannang et al., 2024) found that forensic

accounting practices reduce creative accounting and improve organisational efficiency. (Okoye et al., 2019) reported that forensic accounting significantly enhances fraud detection and prevention, although litigation processes contribute less to fund recovery. Similarly, (Enofe et al., 2013) showed that integrating forensic practices into organizational structures lowers fraud incidence rates, while (Akhidime, 2016) highlighted the complementary role of auditing and investigative techniques. Technological advancement further strengthens forensic investigations. (Alpay & Usul, 2024) observed that digitalisation transforms auditing into technology-driven processes that improve accuracy and compliance. These findings demonstrate that forensic accounting techniques curb manipulative accounting practices, enhance operational efficiency, and strengthen fraud detection, even as digitalization gradually complements manual practices in regions such as Kurdistan.

H1: The use of forensic accounting tools has a positive and significant impact on fraud detection effectiveness in private sector banking and merchandising companies in Sulaymaniyah City, Kurdistan Region, Iraq.

2.4. *Challenges in forensic accounting*

Despite its potential, forensic accounting implementation faces institutional and operational challenges, including legal constraints, limited data access, organizational resistance to transparency, and weak regulatory enforcement. Agency Theory suggests that managerial resistance may arise when enhanced oversight threatens existing power structures. (Basannang et al., 2024) argue that weak internal controls and inadequate supervision create environments conducive to fraud. Additionally, emerging markets often experience cultural and institutional barriers that hinder forensic investigations. (Wahyuandari, 2025) highlights that shortages of trained forensic professionals and ineffective monitoring systems further reduce fraud detection capability. Such challenges are particularly evident in the Kurdistan Region, where legislative gaps and limited forensic capacity constrain effective implementation.

There is no doubt that techniques are vital in support of forensic accounting; however, various studies have pinpointed factors that impede forensic accounting efficacy. Using Jordan as a sample, some of the issues identified by (Abadi et al., 2021) identifies limited professional experience, inadequate technological availability, and weak stakeholder cooperation as major barriers to effective forensic accounting.

(Laufs & Borrion, 2022) further demonstrate that traditional forensic approaches are insufficient for detecting cyber-enabled fraud in increasingly digital business environments. Similar challenges exist in the Kurdistan Region, where slow regulatory development, limited forensic technologies, and reliance on manual auditing constrain fraud prevention efforts. Nevertheless, forensic and legal accountants interviewed in the area suggested that these constraints may encourage organizations to strengthen internal monitoring systems and develop adaptive resilience in low-technology environments.

H2: Challenges faced in implementing forensic accounting practices have a negative effect on fraud detection effectiveness in private sector banking and merchandising companies in Sulaymaniyah City, Kurdistan Region, Iraq.

2.5. Skills and professional competence of forensic accountants

The effectiveness of forensic accounting depends heavily on the competencies of forensic accountants. Competency theory suggests that successful fraud detection relies not only on investigative techniques but also on the knowledge and skills required to apply them effectively. (AL-Hadi & Al-Shaibany, 2024), define competency as the combination of abilities necessary to perform professional tasks efficiently. Key competencies include analytical thinking, communication ability, legal knowledge, and technological expertise, such as digital forensics and data analytics. (Wahyuni et al., 2024) emphasize that professional expertise significantly improves fraud detection outcomes.

Empirical research further highlights the importance of professional skills. (Adejumo & Ogburie, 2025) show that integrating investigative expertise with emerging technologies such as artificial intelligence, blockchain, and big data analytics strengthens fraud detection capacity. (Idrus et al., 2024) note that the combined presence of specialised skills, advanced technology, and supportive legal frameworks reduces fraud risks across different institutional contexts. (Hossain, 2023) also recommends incorporating cybersecurity and AI-based anomaly detection into forensic accounting practices to address evolving digital fraud.

Evidence from (Enofe et al., 2013) demonstrates that analytical, legal, and technological competencies collectively enhance fraud detection effectiveness. Overall, empirical findings indicate that fraud detection outcomes depend on three interconnected

dimensions: forensic techniques, professional skills, and contextual challenges. Techniques guide investigative processes, skills ensure effective application, and challenges influence overall performance. This study therefore, examines their combined impact on fraud detection efficiency in private banks and merchandising firms in Sulaymaniyah.

H3: The skill level of forensic accountants has a positive and significant relationship with fraud detection effectiveness in private sector banking and merchandising companies in Sulaymaniyah City, Kurdistan Region, Iraq.

3. Methodology

3.1. Research design

The study employed a quantitative research design. Semi-structured interviews were conducted prior the survey solely to inform the development of the questionnaire and were not used as part of the main data collection or analysis. Data collection took place in Sulaymaniyah, Kurdistan Region, Iraq. Therefore, the study is classified as quantitative, with interviews serving only as a preliminary step for instrument development.

3.2. Population & sampling

The target population consists of forensic accountants and accounting professionals working in private banks and merchandising companies in Sulaymaniyah. A stratified sampling technique was applied based on industry and job function. Only respondents with at least one year of professional experience were eligible to participate, while interns and individuals on leave were excluded. Questionnaires were distributed through email, phone contact, direct visits, and online platforms. Nonresponse bias tests indicated no significant demographic differences between respondents.

3.3. Qualitative phase

Before designing the questionnaire, preliminary semi-structured interviews were conducted with eight forensic accountants to gather practical insights and ensure the relevance of questionnaire items. The interviews lasted between 30 and 60 minutes and were recorded and transcribed. The information obtained was used only to support questionnaire development and was not included in the main statistical analysis.

3.4. Conceptual framework

3.4.1. Forensic accounting: Concept, function, importance

The AICPA defines Forensic accounting is a unique field of accounting that utilizes accounting, auditing, and investigative skills to collect, analyze, and present evidence relating to financial statements and transactions for use in criminal and civil legal matters (Wan et al., 2022). CFA, Certified Fraud Auditor, combines the financial expertise with legal background to identify, investigate, and prevent fraud, corruption, embezzlement, and other financial irregularities (Tuysuz, 2021). Forensic accountants can also collaborate with law enforcement agencies, lawyers, and courts, providing it with evidence and expert testimony. By utilizing investigative and analytical skills, forensic accounting can help identify and prevent financial fraud in a variety of ways. It exposes discrepancies, errors, and fraud in financial records. Forensic accountants provide evidence-based analyses to influence legal proceedings and increase fraud detection effectiveness. Financial fraud usually penetrates the organization before it is recognized, and forensic accounting is an investigative and analytical skill that contributes to the detection and prevention of financial fraud (Wahyuandari, 2025). It reveals discrepancies and also errors in financial statements and fraud. Forensic accountants underpin legal proceedings using evidence-based analysis and increase fraud detection efficiency (Đukić et al., 2023). Forensic accounting protects organizations from significant financial losses, legal sanctions and reputational damage from increasingly sophisticated financial crimes. As a result, it also assists judicial processes by providing accurate and neutral economic evidence.

3.4.2. Forensic accounting techniques

Techniques—techniques that combine and considers the specialized investigative methods, analytical skills, and professional techniques needed to detect, prevent, and investigate fraud and misconduct—a blend of accounting, audit, and legal knowledge and investigatory skills achieve a comprehensive understanding and familiarity with the skills required. These techniques incorporate a wide variety of things, such as data-mining techniques employed for risk management, fraud detection, and investment strategy development (Tan, 2024)., forensic audits for the verification of independently created records (Agboare, 2021). transaction analysis for the tracing of suspicious financial transactions. and pattern recognition for the identification of recurring fraud schemes. We also explore how anomaly detection can be utilized for detecting departures from standard financial behavior, and digital forensics can play a role in

the recovery and analysis of electronic evidence. Corporate financial statement analysis, potential manipulation, and manipulation is revealed through interview techniques to obtain vital information from stakeholders and the use of state-of-the-art fraud detection technologies that provide an accurate and efficient investigation. (Alabdullah et al., 2014) says forensic accounting methods play a role in unveiling and discovering crime perpetrators. Taken together, these techniques allow forensic accountants to detect anomalies, to detect suspicious patterns of fraud, and to create court-admissible evidence.

3.4.3. Challenges

Challenges — Barriers are also referred to as challenges in this article and are obstacles that constrain the effectiveness of forensic accounting measures, and by so doing, limit the ability to detect and respond to fraudulent financial activities. These are amongst the obstacles that there are: weak legal frameworks and jurisdictional distinctions (between the KRG and Iraq's federal government) that make execution/legal processes more complicated, to name a few. Limited access to reliable financial data, data quality issues, and limited access to the original financial records do not allow for accurate and expansive investigations (Đukić et al., 2023). Furthermore, the resistance of management, radical organizational cultures, and interventions by political parties have compromised the independence of forensic accountants. Lack of expertise and technological barriers limit the scope of advanced fraud detection techniques, according to (Hossain, 2023). Together, these issues represent potential obstacles to complete, and therefore highly effective, forensic accounting and fraud detection work. Source: (Abbadi et al., 2021) emphasized that countries concerned with fraud crimes and that adopt forensic accounting practices are likely to encounter fewer difficulties in overcoming the challenges associated with its application.

3.4.4. Skills of forensic accountant

Skills — Skills are the professional focus that forensic accountants should have, (Wahyuni et al., 2024). These include analytical skills, investigative expertise, communication abilities, and legal and technology skills. (Adejumo & Ogburie, 2025) explained that power of investigation and legal interpretation are required to detect fraud, the decision reads. Accountants with these skills and capabilities will be better positioned to identify red flags, dissect complex financial details, understand legal frameworks, and use emerging technologies. Together, they provide the skills needed to perform a comprehensive investigation and improve fraud detection results.

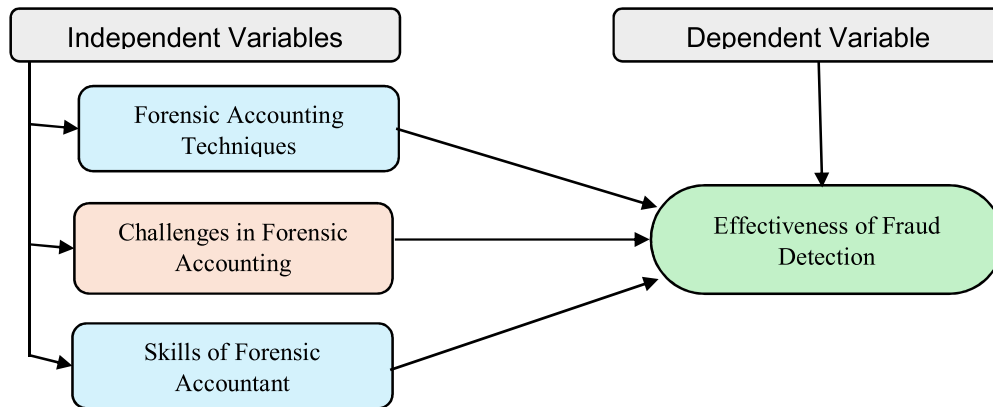


Fig. 1. Research framework.
Source: Prepared by the researchers.

3.4.5. Fraud detection effectiveness

Fraud Detection Effectiveness—the effectiveness of an entity’s ability to identify, prevent, and mitigate fraud accurately, timely, and continually. It can be measured not only in terms of traditional performance measures (i.e., fraud detection rates, false positives and negatives, detection speed, financial loss recovery and variety of fraud types detected), but also in terms of organizational and contextual measures. These factors include the ready availability and accessibility to reliable financial data or records, the professional competency of forensic accountants, the speed at which fraud cases are resolved once detected and the degree by which corporate culture encourages transparency and accountability. Together, this variable would represent the participatory role of forensic accounting alongside organizational capacity that will help in early detection of frauds and preventing wider damage along with loss recovery through investigation. This finding is similarly evidential among the findings of the more recent study such as (Gresoi et al., 2025) which determined that indeed machine learning algorithms improved both the accuracy and the timeliness of the fraud detection process and hence reinforces the overall fraud detection performance and overall firms preparation to take effect.

3.5. Conceptual model

The theoretical model represents the hypothesized relationships between the constructs of the study. The quality of fraud detection (QFD) is positively impacted by methods and tools: it would improve the effectiveness of detection, increase the accuracy of investigation, and make the detection intervention timelier. Conversely, obstacles are projected to negatively affect, as legal, organizational, and re-

source barriers would hinder the accessibility of information, the effectiveness of investigations, and, eventually, the capacity of fraud detection mechanisms. As shown in Fig. 1, the research framework illustrates the relationships between the independent variables (methods, tools, and obstacles) and the dependent variable (quality of fraud detection).

3.6. Regression model

Based on the conceptual framework, the relationships among the study variables can be expressed in the following regression equation:

$$FDE = \beta_0 + \beta_1 T + \beta_2 C + \beta_3 S + \varepsilon \quad (1)$$

The model fit was assessed using R^2 , adjusted R^2 , F-statistics, and significance levels ($p < 0.05$).

FDE: Fraud Detection Effectiveness.

T: Forensic Accounting Tools (Techniques).

C: Forensic Accounting Challenges.

S: Forensic Accountant Skills.

Parameters: β_0 : Intercept (constant term).

$\beta_1, \beta_2, \beta_3$: Regression coefficients measuring the effect of each predictor.

ε Random error capturing unexplained variance.

3.7. Statistical adequacy and sample size

IBM SPSS Statistics version 23 was used for data analysis. Cronbach’s alpha was calculated to assess the reliability of the constructs. Sampling adequacy and factorability were evaluated using the Kaiser–Meyer–Olkin (KMO) measure, Bartlett’s Test of Sphericity, and determinant values. Factor loadings were examined to confirm the validity of the measurement model. A total of 74 valid responses were obtained. Although the sample size is relatively small,

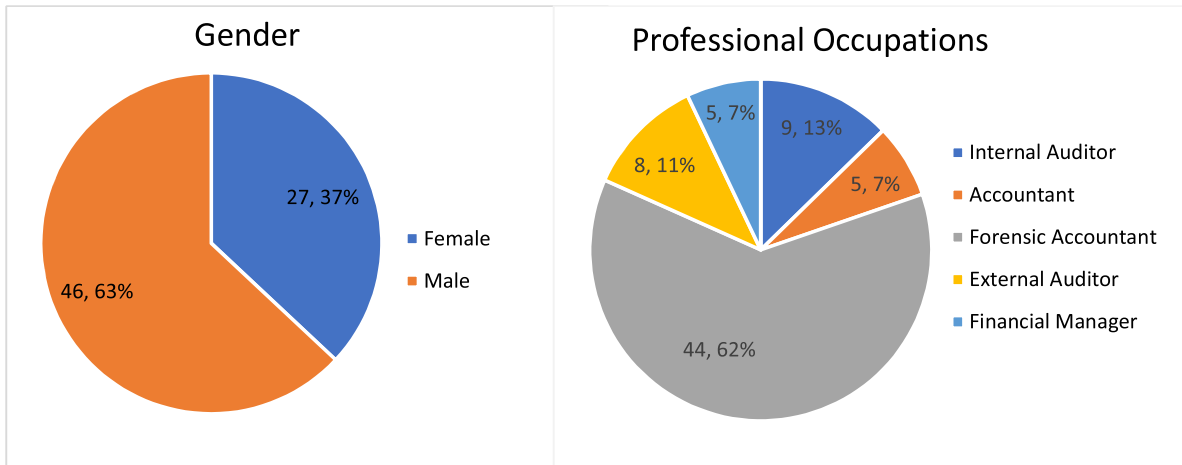


Fig. 2. Gender distribution of respondents and professional occupations.
 (a) Gender distribution of respondents
 (b) Professional occupations
 Source: Microsoft Excel 2016 data processing.

it is adequate for exploratory linear regression analysis, and the findings should be interpreted cautiously and validated in future studies with larger samples.

4. Results

4.1. Descriptive statistics

As shown in Fig. 2, the descriptive results illustrate (a) the gender distribution of respondents and (b) their professional occupations.

4.1.1. Gender distribution of respondents

The gender pie chart illustrates the distribution of respondents by gender, showing that 63% are male and 37% are female. This indicates that males constitute the majority of the study sample. The gender imbalance suggests that male perspectives may have a stronger influence on the findings.

4.1.2. Professional occupations

The professional occupations pie chart presents the distribution of respondents by occupation, with the majority being forensic accountants (62%). Other

roles include internal auditors (13%), external auditors (11%), accountants (7%), and financial managers (7%). This shows that the sample is strongly concentrated in forensic accounting, which aligns with the focus of the study.

4.1.3. Educational qualification and work experience

The Table 1 illustrates the distribution of respondents according to both their educational qualifications and work experience. In terms of education, the majority of respondents hold a Bachelor’s degree (61%), followed by those with a Master’s degree (20%) and a Ph.D. (14%), while only a small proportion possess a Diploma (5%). This indicates that most participants are highly educated, with a significant share having postgraduate qualifications.

Regarding professional experience, the largest group of respondents reported 6–10 years of work experience (51%), reflecting a strong mid-career representation. Meanwhile, 29% of respondents had more than 10 years of experience, suggesting the presence of seasoned professionals, whereas 20% had relatively shorter experience of 2–5 years.

Table 1. Distribution of respondents by educational qualification and work experience.

Educational Qualification	Work Experience	
	Frequency (n)	Percentage (%)
Diploma	4	5%
Bachelor	45	61%
Master	15	20%
Ph.D.	10	14%
Total	74	100%

Source: SPSS Version 23 data processing.

Table 2. Reliability statistics.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.876	.885	4

Source: SPSS Version 23 data processing.

Overall, the data shows that the study sample is composed of respondents with a solid academic background and substantial professional experience, enhancing the reliability of their perspectives on forensic accounting and related practices.

4.2. Reliability and validity

4.2.1. Reliability

As presented in Table 2, the four-item scale was internally consistent with a Cronbach's Alpha of 0.876. The standardized coefficient of 0.885 makes it a stronger inference that the items were measured on the same metric and were contributing consistently to the construct. Given that values > 0.80 are typically interpreted as reflecting very good reliability, these results support that the instrument is reliable and suitable for further statistical analyses.

4.2.2. Validity

Table 3 sampling adequacy tests confirmed that the dataset was appropriate for factor analysis. The KMO measure, Kaiser–Meyer–Olkin, was 0.835, which was higher than the acceptable level of 0.80 and suggested a meritorious sampling adequacy. Bartlett's Test of Sphericity yielded a Chi-square value of 153.611 with 6 degrees of freedom ($p < 0.001$), rejecting the null hypothesis of an identity matrix and allowing us to conclude that the variables have a substantial common variance to allow factor extraction. An evaluation of the correlation matrix shows that its determinant was 0.111, indicating no multicollinearity. PCA extracted one component with factor loadings between 0.828 (X3) and 0.895 (Y). All loadings were above the widely accepted cut-off value of 0.70, showing a strong association between each variable and the underlying component.

4.2.3. Correlation analysis

The results are summarized in Table 4, which presents the correlation matrix among the study variables. The analysis shows that all three independent variables—techniques (X1), challenges (X2), and accountants' skills (X3)—are positively correlated with fraud detection effectiveness (FDE, Y). Techniques exhibit the strongest correlation with FDE ($r = 0.741$), followed by challenges ($r = 0.683$) and accountants'

skills ($r = 0.652$). In addition, the intercorrelations among the independent variables are moderate (techniques–challenges: $r = 0.654$; techniques–skills: $r = 0.622$; challenges–skills: $r = 0.601$), indicating some shared variance but not at a level that suggests problematic multicollinearity. Overall, the findings suggest that effective forensic accounting techniques, the ability to overcome challenges, and accountants' skills all contribute significantly to improving fraud detection effectiveness.

4.3. Regression analysis

Table 5 (Model Summary) indicates a strong overall relationship for the multiple regression model: techniques (X1), challenges (X2), and accountants' skills (X3) as the predictors and fraud detection efficiency (Y) as the dependent variable. Now this model produced a multiple correlation coefficient of 0.805 ($R=0.804$), indicating a significant association between the predictors and the outcome variable. The coefficient of determination ($R^2 = 0.646$) showed that approximately 64.6% of the variability in the effectiveness of detecting fraud can be attributed to variation in the three predictors jointly. The adjusted R^2 (0.631) confirmed the stability of the model by adjusting the number of predictors based on the number of analyzed subjects, reducing the risk of an overestimated model fit. The standard error of the estimate was 1.902, indicating the average distance of the observed values from the predicted regression line was small, and thus the model fit this fairly well.

As shown in Table 6, the ANOVA table results confirm this regression model was statistically significant, $F(3,69) = 41.968$, $p < 0.001$. This implies that techniques (the first predictor), challenges (the second predictor), and accountants' skill (the third predictor) combined are contributing to the variance in fraud detection effectiveness. The F-value is large, indicating that the model is doing a lot better than chance and confirming that these predictors significantly contribute to a better understanding of and prediction of fraud detection effectiveness.

Regression coefficients

The regression results are summarized in Table 7, which presents the coefficients of the multiple regression analysis for predicting fraud detection effectiveness. The results indicate that all three independent variables significantly contribute to fraud detection effectiveness. Specifically, techniques (X1: $B = 0.424$, $\beta = 0.330$, $p < 0.001$) represent the strongest predictor, followed by challenges (X2: $B = 0.270$, $\beta = 0.223$, $p = 0.009$) and accountants' skills (X3: $B = 0.226$, $\beta = 0.275$, $p = 0.023$). The 95% confidence intervals

Table 3. Factor analysis results: KMO, bartlett's test, and factor loadings.

Section	Test/Variable	Value
Correlation Matrix	Determinant	0.111
	Kaiser–Meyer–Olkin (KMO) Measure	0.835
Sampling Adequacy	Bartlett's Test of Sphericity – Approx. χ^2	153.611
	Degrees of Freedom (df)	6
	Significance (p-value)	0.000
	Factor Loadings (Component Matrix*)	
	X1	0.877
	X2	0.850
	X3	0.828
	Y	0.895
Extraction Method	Principal Component Analysis; one component extracted	–

Source: SPSS Version 23 data processing.

Note: Extraction method used was Principal Component Analysis (PCA) with a single component extracted based on eigenvalues and factor structure.

Table 4. Correlation matrix.

Correlations	FDE (Y)	Techniques	Challenges	Skills
Pearson Correlation				
FDE (Y)	1			
Techniques (X1)	.741	1		
Challenges (X2)	.683	.654	1	
Skills (X3)	.652	.622	.601	1

Source: SPSS Version 23 data processing.

for all predictors are positive and do not include zero, confirming the statistical robustness of the model. In addition, multicollinearity diagnostics indicate no serious issues, as tolerance values are above 0.40 and VIF values are below 2.1, indicating stable and reliable regression estimates.

4.4. Hypothesis testing

H1: Techniques have a positive effect on the effectiveness of fraud detection.

This hypothesis was supported. As shown in Table 7, the regression analysis showed that techniques positively impacted the effectiveness of fraud detection ($B = 0.330, \beta = 0.424, p < 0.001$). That means using forensic accounting techniques significantly improves the fraud detection capability of organizations.

H2: Challenges have an adverse effect on effective fraud detection.

This hypothesis was not supported. While the association between challenges and fraud detection effectiveness was significant ($B = 0.223, \beta = 0.270, p = 0.009$), the direction of the effect was positive, which was contrary to the expected negative sign in relation to the theoretical relevance. That means challenges may not only lead organizations to cut back but could instead challenge organizations to strengthen defences, shore up forensic practices, and further resource fraud detection. Therefore, H2 was rejected.

H3: The effect of fraud detection effectiveness is driven by accountants' skills.

This hypothesis was supported. Results showed that accountants' founded skills were a significant positive predictor of fraud detection ($B = 0.275, \beta = 0.226, p = 0.023$). This emphasizes the importance of professional skills like analytical ability, investigation, and legal/technological knowledge to build essential competencies to enhance fraud detection.

4.5. Findings integration - quantitative & qualitative

4.5.1. Techniques

The regression indicated that techniques had the highest positive impact on fraud detection effectiveness ($B = 0.330; \beta = 0.424; p < 0.001$). While this was confirmed by interview data, a crucial contextual nuance was revealed: forensic accountants worked primarily with manual techniques in Sulaymaniyah (transaction analysis, documentation review, and financial statement examination), as opposed to more advanced and equipped forensic tools. Respondents stressed that limited, systematic manual methods are still effective for identifying anomalies, while digital tools are even more limited in available solutions. As one practitioner stated, "Even in the absence of digital systems, meticulous analysis of books still helps us uncover fraud." This is why techniques, even with a planned constrained environment, remained the most likely single-set predictor.

4.5.2. Challenges

Results of quantitative analysis revealed that challenges positively contributed to fraud detection effectiveness ($B = 0.223, \beta = 0.270, p = 0.009$), which was opposite of the hypothesis. Interviews clarified this paradox: accountants expressed those barriers—such as poor legal environments, management resistance, and lack of technology—compel organizations to re-inforce process auditing, streamline documentation,

Table 5. Model summary.

M	R	R Square	Adjusted R Square	Std. Error	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.804 ^a	.646	.631	1.90237	.646	41.968	3	69	.000

Source: SPSS Version 23 data processing.

Table 6. ANOVA test.

Model	Sum of Squares	df	Mean Square	F	Sig.
1					
Regression	455.653	3	151.884	41.968	.000 ^b
Residual	249.712	69	3.619		
Total	705.364	72			

Source: SPSS Version 23 data processing.

and enhance transparency. As infamously articulated by one of its participants: “When the process is brutal, we hustle and double-check every step—which ironically compounds the detection.” Hence, the challenges in Sulaymaniyah seem to act as motivations for rigorous manual methods, which increase the ability to detect fraud as well.

4.5.3. Skills of accountants

The statistical results indicated that skills positively impacted fraud detection effectiveness ($B = 0.275$, $\beta = 0.226$, $p = 0.023$). Both quantitative and qualitative findings further illustrated that, on account of the absence of digital tools, professional skills—including analytical reasoning, investigative judgement, and knowledge of accountancy procedures—became all the more important. Ability & Experience Surpass Technique Interviewees reiterated that “manual techniques only go so far in the hands of good accountants.” It means forensic accountants’ expertise is the backbone of fraud detection in the Kurdistan context and compensate for technological limitations.

5. Discussion

5.1. Comparative analysis with previous studies

The results confirm that forensic accounting techniques, challenges, and accountants’ skills significantly influence fraud detection effectiveness. The significant influence of techniques ($\beta = 0.424$, $p < 0.001$) concurs with [Ijeoma \(2015\)](#) and [Okoye et al. \(2019\)](#) previous studies, indicating that the systematic forensic techniques, including document examination and data analysis, enhance the detection of fraud and confidence in financial reporting. Similarly, the positive influence of accountants’ skills ($\beta = 0.226$, $p = 0.023$) is in line with the findings from [Adejumo and Ogburie \(2025\)](#) and [Hossain \(2023\)](#), which state that fraudulent detection requires expertise in

analytical reasoning as well as knowledge of civil and criminal law and investigative procedures to provide for the accurate and reliable detection of fraud.

Nonetheless, this study differs from the majority of the challenges literature. Although authors like ([Ab-badi et al., 2021](#)) & ([Đukić et al., 2023](#)) emphasized that legal, cultural, and technological barriers reduce the efficacy of fraud detection, the present findings showed a strong positive relationship ($\beta = 0.270$, $p = 0.009$). The challenges would seem to act as a catalyst for organizations in the case of Sulaymaniyah to reinforce resilience by encouraging adaptive practices and more robust internal controls. This builds on prior work by demonstrating that contextual parameters can overturn theoretical predictions.

5.2. Private sector fraud detection strategies

There are three implications for the context of private banks and merchandising firms in Sulaymaniyah:

- Techniques – The confirmation of H1 highlights the importance of having a systematic approach (i.e., forensic accounting elaborates on the need to adopt investigative procedures and techniques) that goes beyond normal audit procedures. While advanced digital tools are beneficial ([AL-Hadi & Al-Shaibany, 2024](#)), well-built manual processes remain critical to enhancing fraud detection and prevention.
- Challenges – Institutional and technological limitations, like poor regulatory enforcement or limited access to forensic technologies, should not only be viewed as barriers but also as opportunities for change. Such constraints have compelled firms to impose stricter reporting arrangements, clearer duty separation, and tighter monitoring of compliance procedures, contributing to the fortification of internal control systems ([Manginte, 2024](#)).
- Skills—The affirmation of H3 emphasizes the high importance of professional skills. It is, in that sense, especially where the dominant practice hinges upon the manual, a continuous training course in the investigative interview, analytical reasoning, and meeting the legal standard’s needs; it can enhance accountants talented at detecting and combating fraud.

Table 7. Regression analysis.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1							
(Const.)	8.315	2.998		2.773	.007		
X1	.330	.080	.424	4.143	.000	.490	2.042
X2	.223	.083	.270	2.694	.009	.511	1.959
X3	.275	.118	.226	2.333	.023	.548	1.826

Source: SPSS Version 23 data processing.

5.3. The unique context of the Kurdistan region

One of the central contributions of this study is its contextualization. Compared to Western countries, where technology-based forensic accounting tools and sophisticated digital forensics are gaining dominance (Olusegun, 2023; Omar, 2025), and (AL-Hadi & Al-Shaibany, 2024), the forensic accounting practices in Sulaymaniyah are largely manual. This is a setting in which fraud detection is based on expert judgment with extensive document review and dynamic organizational practices, rather than automated systems. Specifically, the surprising positive relationship between challenges and fraud detection effectiveness is indicative of localized resilience; organizations, particularly in systemic constraints of weak regulatory enforcement and limited technological infrastructure, have become accustomed to such environments, and coping with them ultimately paradoxically fortifies their fraud detection capabilities. Editorial: Results highlight the importance of developing fraud prevention mechanisms most appropriate to the unique institutional, cultural, and organizational context of the Kurdistan Region, rather than relying solely on global models.

6. Conclusion

This study examined the effect of forensic accounting techniques, challenges, and accountants' skills on fraud detection in private banks and merchandising companies in Sulaymaniyah, Kurdistan Region, Iraq. All three factors significantly influenced fraud detection, with techniques having the strongest effect, followed by challenges and skills. The findings highlight that professional tools and competencies are essential for effective fraud prevention. Strengthening internal controls and enhancing forensic accountants' skills through specialized training are crucial. Practically, organizations should adopt localized strategies, improve internal monitoring systems, and integrate digital forensic tools alongside traditional methods to enhance fraud detection and build more resilient financial systems (Tan, 2024).

7. Recommendations

Forensic accountants should continuously develop analytical, investigative, and legal skills, including digital forensics, combining manual review with advanced techniques like data mining and collaborating with auditors and attorneys to assess risks comprehensively. Company managers need to strengthen internal controls through duty segregation, transparent reporting, and regular review beyond ledgers, while training staff to detect and report anomalies early to prevent larger issues. Policymakers should update regulations to support forensic accounting, provide access to digital tools, training, and certification, and promote information-sharing among businesses, banks, and authorities to enhance fraud prevention. Future researchers are encouraged to compare banking and non-banking sectors, conduct longitudinal studies, explore emerging digital tools such as AI, blockchain, and cybersecurity, assess regional differences in fraud detection, and combine surveys with in-interviews of key stakeholders to gain nuanced insights.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Authors' declaration

We Hereby Confirm That All the Figures and Tables in The Manuscript Are Mine and Ours. Besides,

The Figures and Images, which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

- No animal studies are present in the manuscript.
- No human studies are present in the manuscript.
- Ethical Clearance: Research Was Approved by

The Local Ethical Committee in The University of Baghdad.

Data availability

The data used in this study are available from us upon reasonable request.

Author contributions

The author was responsible for conceptualization, methodology, data collection, data analysis, interpretation of results, and writing of the manuscript.

References

- Abbadi, H. M. Al, Alrawashdeh, B., Dabaghia, M. N., & Darwazeh, R. N. (2021). The challenges of application of forensic accounting in Jordan. *Academy of Strategic Management Journal*, 20(Special Issue 2), 1–10. https://www.abacademies.org/articles/the-challenges-of-application-of-forensic-accounting-in-jordan.pdf?utm_source=chatgpt.com
- Adejumo, A., & Ogburie, C. (2025). Forensic accounting in financial fraud detection: Trends and challenges. *International Journal of Science and Research Archive*, 14(3), 1219–1232. <https://doi.org/10.30574/ijstra.2025.14.3.0815>
- Agboare, E. I. (2021). Impact of forensic accounting on financial fraud detection in deposit money banks in Nigeria. *African Journal of Accounting and Financial Research*, 4(3), 74–119. <https://doi.org/10.52589/ajaf-ruc0s0iq>
- Akhidime, A. E. (2016). Bridging audit expectation gap with the integration of forensic accounting: a review. *AEFUNAI Journal of Accounting, Business and Finance (FJABAF)*, April, 72–82. <https://www.fjabaf.org/wp-content/uploads/2018/06/Bridging-Audit-Expectation-Gap-with-the-Integration-of-Forensic-Accounting-A-Review.pdf>
- AL-Hadi, F. I., & Al-Shaibany, N. A. (2024). Digital forensic accounting: An overview. *International Journal of Computer Science and Mobile Computing*, 13(8), 99–106. <https://doi.org/10.47760/ijscmc.2024.v13i08.011>
- Alabdullah, T. T. Y., Alfadhl, M. M. A., Yahya, S., & Rabi, A. M. A. (2014). The role of forensic accounting in reducing financial corruption: A study in Iraq. *International Journal of Business and Management*, 9(1), 26–34. <https://doi.org/10.5539/ijbm.v9n1p26>
- Alpay, M. F., & Usul, H. (2024). From traditional auditing to information technology auditing: A paradigm shift in practices. *European Journal of Digital Economy Research*, 5(1), 3–9. <https://orcid.org/0000-0002-3930-0866>
- Basannang, S. M., Darmayanti, N., & Lestari, T. (2024). The effect of operational audit and internal control on performance. *Journal of Economic and Economic Policy*, 1(4), 78–87. <https://doi.org/10.61796/ijecep.v1i4.48>
- Celestin, M., & Vanitha, N. (2019). Artificial intelligence in fraud detection: Are traditional auditing methods outdated? *2nd International Conference on Recent Trends in Arts, Science, Engineering & Technology*, 3(2), 180–186. https://www.researchgate.net/publication/385822047_ARTIFICIAL_INTELLIGENCE_IN_FRAUD_DETECTION_ARE_TRADITIONAL_AUDITING_METHODS_OUTDATED?utm_source=chatgpt.com
- Currall, S. C., & Epstein, M. J. (2003). The fragility of organizational trust: Lessons from the rise and fall of Enron. *Organizational Dynamics*, 32(2), 193–206. [https://doi.org/10.1016/S0090-2616\(03\)00018-4](https://doi.org/10.1016/S0090-2616(03)00018-4)
- Dukić, T., Pavlović, M., & Grdinić, V. (2023). Uncovering financial fraud: The vital role of forensic accounting and auditing in modern business practice. *Economic Themes*, 61(3), 407–418. <https://doi.org/10.2478/ethemes-2023-0021>
- Enofe, A. O., Okpako, P. O., & Atube, E. N. (2013). The impact of forensic accounting on fraud detection. *European Journal of Business and Management*, 5(26), 61–73. https://www.iiste.org/Journals/index.php/EJBM/article/view/8063?utm_source=chatgpt.com
- Gabrielli, G., Magri, C., Mediolini, A., & Marchini, P. L. (2024). The power of big data affordances to reshape anti-fraud strategies. *Technological Forecasting and Social Change*, 205, 123507. <https://doi.org/10.1016/j.techfore.2024.123507>
- Gresoi, S., Stamatescu, G., & Făgărășan, I. (2025). Advanced methodology for fraud detection in energy using machine learning algorithms. *Applied Sciences (Switzerland)*, 15(6), 1–25. <https://doi.org/10.3390/app15063361>
- Hossain, M. Z. (2023). Emerging trends in forensic accounting: Data analytics, cyber forensic accounting, cryptocurrencies, and blockchain technology for fraud investigation and prevention. *SSRN Electronic Journal*, 4450488. <https://doi.org/10.2139/ssrn.4450488>
- Idrus, M., Adriana, N., Rustam, A., Sulistyowati, N. W., & Rewa, K. A. (2024). The impact of forensic accounting on financial fraud prevention: A comparative analysis across countries. *The Journal of Academic Science*, 1(8), 1074–1084. <https://doi.org/10.59613/m6jrt421>
- Ijeoma, B. (2015). Empirical analysis on the use of forensic accounting techniques in curbing creative accounting. *International Journal of Economics, Commerce and Management*, 3(1), 1–20. <http://ijecm.co.uk/wp-content/uploads/2015/01/3127.pdf>
- Laufs, J., & Borrión, H. (2022). Technological innovation in policing and crime prevention: Practitioner perspectives from London. *International Journal of Police Science and Management*, 24(2), 190–209. <https://doi.org/10.1177/14613557211064053>
- Leukfeldt, E. R., & Yar, M. (2016). Applying routine activity theory to cybercrime: A theoretical and empirical analysis. *Deviant Behavior*, 37(3), 263–280. <https://doi.org/10.1080/01639625.2015.1012409>
- Manginte, S. Y. (2024). Fortifying transparency: Enhancing corporate governance through robust internal control mechanisms. *Advances in Management & Financial Reporting*, 2(2), 72–84. <https://doi.org/10.60079/amfr.v2i2.173>
- Okoye, E., Segun, I., & Obioma, J. (2019). Fortifying transparency: Enhancing corporate governance through robust internal control mechanisms. *International Journal of Economics, Business and Management Research*, 3(12), 149–153. <https://ijecm.co.uk/wp-content/uploads/2022/01/10113.pdf>
- Olusegun, D. H. (2023). The impact of forensic accounting skills and techniques in the investigation of corrupt practices. *Global Scientific Journal (GSJ)*, 11(9), 897–937. https://www.globalscientificjournal.com/researchpaper/THE_IMPACT_OF_FORENSIC_ACCOUNTING_SKILLS_AND_TECHNIQUES_IN_THE_INVESTIGATION_OF_CORRUPT_PRACTICES_.pdf?utm_source=chatgpt.com
- Omar, M. S. (2025). The impact of forensic accounting in rationalizing judicial decisions in Iraq. *Journal of Economics and Social Research*, 6(1), 66–85. <https://doi.org/10.53662/esamdergisi.1507180>
- Oti-Akenteng, E., Ocansey, E. O. N. D., & Asamoah, F. O. (2025). The impact of digitalization on revenue generation, public participation, and allocation efficiency. *International Journal of Science and Research Archive*, 14(3), 1761–1777. <https://doi.org/10.47941/jacc.2763>
- Pranta, A. D., Repon, M. R., Haji, A., Rahman, M., & Rahman, M. M. (2025). Sustainable merchandising for recycled textiles and apparel in the western apparel industry: Strategies, challenges and market opportunities. *Journal of Engineered Fibers and Fabrics*, 20. <https://doi.org/10.1177/15589250251359273>

- Schuchter, A., & Levi, M. (2016). The fraud triangle revisited. *Security Journal*, 29(2), 107–121. <https://doi.org/10.1057/sj.2013.1>
- Singleton, T. A. P. and T. W. (2020). Fraud and forensic accounting in the digital environment. *Issues in Accounting Education*, 23(4), 545–559. https://doi.org/10.1007/978-3-030-25726-2_1
- Tan, W. (2024). Big data and data mining: Techniques for discovering hidden insights. *American Journal Of Big Data*, 05(03), 12–15. https://australiansciencejournals.com/bigdata/article/view/806?utm_source=chatgpt.com
- Tuysuz, H. Ö. K. and Z. (2021). Auditing ecosystem and strategic accounting in the digital era. In T. A. and U. Hacıoglu (Ed.), *Contributions to Finance and Accounting* (Issue June 2021). Springer International Publishing, Switzerland, 2021. <https://doi.org/10.1007/978-3-030-72628-7>
- Wahyuandari, W. (2025). The role of forensic auditing in detecting and preventing financial fraud in organizations. *The Journal of Academic Science*, 2(1), 212–221. <https://doi.org/10.59613/1hay7432>
- Wahyuni, I. S., Zainuddin, Y., & Haron, H. (2024). The expertise skills of a forensic accountant. *Journal E-Business And Management Science*, 2(1), 206–218. <https://doi.org/https://doi.org/10.61098/jems.v3i1.140>
- Wan, Y., Fairuz, M., Salleh, M., & Barzinji, Z. (2022). The effect of forensic accounting on fraud prevention: The moderating role of internal control effectiveness. *International Journal of Economics, Commerce and Management United Kingdom*, x(January), 213–230. https://ijecm.co.uk/wp-content/uploads/2022/01/10113.pdf?utm_source=chatgpt.com