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**Effects of Forensic Accounting Techniques on Fraud Investigation
Effectiveness in Plateau State MDAs**

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ABSTRACT

This study examined the effects of forensic accounting techniques on fraud investigation effectiveness within the Internal Audit Units of Ministries, Departments and Agencies (MDAs) in Plateau State, Nigeria. The study was based on a population of 132 heads of Auditing and audit staff in the sixty-six (66) MDAs, and a sample size of 99 were selected using Taro Yamane formula. A survey design was adopted, and 99 copies of a structured questionnaire were administered to Internal Audit officers across the selected MDAs and staff of the Auditor-General's Office. Seventy-seven (77) valid responses were analyzed using descriptive statistics, correlation analysis and multiple regression techniques. The findings revealed that Computer-Assisted Audit Techniques (CAATs) and Forensic Data Analytics (FDA) have significant positive effects on fraud investigation effectiveness, demonstrating that technology-driven audit tools substantially improve investigative performance. In contrast, Document Review, Investigative Interview and Evidence-Gathering Techniques showed positive but statistically insignificant effects, indicating capacity gaps in traditional investigative competencies. The model explained 71.6 per cent of the variance in investigative effectiveness. The study recommended that Plateau State should institutionalize the use of Computer-Assisted Audit Techniques and forensic analytics across all MDAs through mandatory deployment of transaction monitoring systems, audit interrogation software, and automated exception reporting platforms, supported by clear operational guidelines and periodic performance reviews, similarly, it recommends that investigative capacity in traditional forensic methods should be strengthened through structured training in interviewing, evidence documentation, digital chain-of-custody management, and document validation, aligned with internationally recognized professional standards.

Keywords: Forensic Accounting Techniques; Fraud Investigation; Computer-Assisted Audit Techniques; Forensic Data Analytics; Public Sector Accountability.

1.0 INTRODUCTION

Fraud remains one of the most persistent governance challenges confronting Nigeria's public sector, undermining fiscal discipline, service delivery and public confidence. Ministries, Departments and Agencies (MDAs) at the state level are particularly vulnerable, as weak oversight mechanisms, bureaucratic discretion and limited investigative capacity create conditions in which complex financial irregularities can flourish. In Plateau State, concerns over procurement abuses, payroll fraud, cash-handling irregularities and revenue leakages continue to raise questions about the effectiveness of existing fraud investigation mechanisms. Strengthening investigative capacity has therefore become central to safeguarding public resources and restoring accountability within sub-national public institutions.

Forensic accounting has emerged globally as a specialised investigative discipline capable of addressing these weaknesses. It integrates accounting, auditing, investigative and legal competencies to reconstruct financial activities, uncover fraud and generate evidence suitable for judicial or administrative processes. Classical and contemporary scholarship emphasises that forensic accounting now relies on advanced tools such as computer-assisted audit technologies, forensic data analytics, structured interviews, digital forensics and litigation-ready evidence procedures (Kranacher & Riley, 2019; Singleton et al., 2010; Silverstone et al., 2012). Recent developments further highlight the role of artificial intelligence, blockchain tracing, machine learning and deep analytics in enhancing fraud detection accuracy and investigative efficiency (Ali et al., 2024; Vijayalakshmi & Jeevan, 2024). These innovations underscore the inadequacy of traditional audit procedures in confronting modern fraud patterns, especially within the public sector where digital footprints and transactional complexity continue to expand.

Empirical studies in Nigeria provide strong evidence supporting the relevance of forensic accounting to fraud detection and investigation. Research confirms that forensic techniques such as data analytics, document examination, forensic interviewing and digital evidence processing significantly improve the quality of investigations and reduce unresolved cases in public sector institutions (Okoye & Gbegi, 2013; Gbegi & Adebisi, 2014; Oyerogba, 2021). However, these studies disproportionately focus on federal agencies, anti-corruption institutions and tertiary institutions. Limited scholarly attention has been directed towards state-level MDAs, despite their heavy involvement in procurement, payroll administration, subventions and revenue generation. This creates a knowledge gap that restricts effective policy intervention at the sub-national level, including Plateau State.

The theoretical foundation for assessing the role of forensic accounting in fraud investigation is rooted in the Fraud Hexagon, Agency Theory and Deterrence Theory. The Fraud Hexagon (Vousinas, 2019) explains that pressure, opportunity, rationalisation, capability, arrogance and collusion interact to produce fraud. These elements align with the realities of Nigerian MDAs, where collusive networks, hierarchical influence and technological loopholes are prevalent. Agency Theory (Jensen & Meckling, 1976) clarifies how information asymmetry and misaligned incentives between citizens (principals) and public officials (agents) facilitate fraudulent behaviour. Deterrence Theory (Becker, 1968) adds that individuals are less likely to engage in fraud where detection is swift, evidence is credible and sanctions are likely. Together, these theories provide a robust analytical lens for examining how forensic accounting techniques counteract the structural and behavioural enablers of fraud.

The aim of this study is to examine the effects of forensic accounting techniques on fraud investigation in Plateau State MDAs. Drawing on five core forensic techniques -

computer-assisted audit techniques, forensic data analytics, document and transaction review procedures, investigative interviewing methods and evidence-gathering practices the study employs a quantitative survey design and multiple regression analysis to assess their influence on fraud investigation outcomes.

Fraud, corruption, financial misappropriation, payroll manipulation, procurement irregularities, and diversion of public funds continue to undermine the efficiency and credibility of Ministries, Departments, and Agencies (MDAs) in Nigeria, including those in Plateau State. Despite the existence of conventional auditing and internal control mechanisms, incidences of financial impropriety persist due to weaknesses in traditional audit procedures, which are often inadequate in detecting sophisticated and concealed fraudulent schemes. Forensic accounting techniques such as data mining, digital forensic investigation, document examination, litigation support, and fraud risk assessment have been identified as effective tools for detecting, investigating, and preventing fraud in the public sector. Empirical studies indicate that the application of forensic accounting techniques significantly improves fraud detection and investigative outcomes in Nigerian public institutions (Gbegi & Adebisi, 2014; Ogiriki & Appah, 2018; Okonkwo & Okegbe, 2025). However, despite growing scholarly attention to forensic accounting in Nigeria, there remains limited empirical evidence on how these techniques influence fraud investigation effectiveness specifically within Plateau State MDAs. This contextual gap creates uncertainty regarding the extent to which forensic accounting practices can enhance fraud investigations, improve evidence gathering, facilitate prosecution, and strengthen accountability in the state's public sector. Consequently, this study seeks to examine the effects of forensic accounting techniques on fraud investigation effectiveness in Plateau State MDAs.

This study contributes to the literature by generating state-level empirical evidence on forensic accounting practice within Nigeria's public sector, an area that remains underexplored. By integrating behavioural, organisational and deterrence-based theories into a unified explanatory framework, the study advances scholarly understanding of fraud investigation in emerging-market governance systems and offers policy-relevant insights capable of strengthening accountability mechanisms in Plateau State and similar contexts across sub-Saharan Africa.

In line with this aim, the study addresses the following research questions:

1. To what extent do Computer-Assisted Audit Techniques affect fraud investigation in Plateau State MDAs?
2. What effect does Forensic Data Analytics have on fraud investigation outcomes?
3. How do Document and Transaction Review Techniques affect the quality of fraud investigation?
4. what is the effect of Investigative and Interview Techniques on fraud investigation effectiveness?
5. What is the effect of Evidence-Gathering and Litigation Techniques on fraud investigation outcomes?
6. To what extent do forensic accounting techniques jointly predict fraud investigation effectiveness within Plateau State MDAs?

The following hypotheses are therefore proposed:

H0₁: Computer-Assisted Audit Techniques have no significant positive effect on fraud investigation in Plateau State MDAs.

H0₂: Forensic Data Analytics have no significant positive effect on fraud investigation in

Plateau State MDAs.

- H0₃:** Document and Transaction Review Techniques have no significant positive effect on fraud investigation in Plateau State MDAs.
- H0₄:** Investigative and Interview Techniques have no significant positive effect on fraud investigation in Plateau State MDAs.
- H0₅:** Evidence-Gathering and Litigation Techniques have no significant positive effect on fraud investigation in Plateau State MDAs.
- H0₆:** Forensic accounting techniques jointly have no significant positive effect on fraud investigation in Plateau State MDAs.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

Forensic accounting involves the application of specialized investigative, analytical and evidentiary techniques to examine financial irregularities, uncover fraudulent activities and support litigation outcomes. Contemporary definitions describe forensic accounting as a synthesis of accounting, auditing, investigative skills, digital forensics and legal analysis designed to reconstruct financial events and expose wrongdoing (Krancher & Riley, 2019; Singleton et al., 2010). The field has expanded significantly in the digital era, driven by the complexity of modern fraud schemes and the inadequacy of traditional auditing techniques (Mert, 2022; Petare, 2025).

Computer-Assisted Audit Techniques (CAATs) constitute the technological foundation of forensic accounting. They permit full-population data testing, anomaly detection and automated extraction of financial information (Sharma & Panigrahi, 2013). Forensic Data Analytics (FDA) goes further by applying statistical modelling, AI, machine learning and pattern-recognition algorithms to detect hidden relationships and suspicious trends (Ali et al., 2024; Vijayalakshmi & Jeevan, 2024). In public sector environments characterized by large and complex datasets, these tools greatly enhance investigative efficiency.

Document and Transaction Review Techniques remain the backbone of forensic examinations. They encompass vouching, tracing, third-party confirmation, digital document scrutiny and reconciliation of financial trails (Silverstone et al., 2012; Manning, 2010). As multiple Nigerian studies show, these techniques are indispensable in detecting procurement fraud, payroll manipulation and unauthorized expenditures within Ministries, Departments and Agencies (Uthman & Adegoke, 2018; Ile & Odimmega, 2018).

Investigative and Interview Techniques integrate psychological assessment, deception detection and structured questioning methods to extract crucial information from suspects and witnesses. Research shows that forensic interview methods outperform traditional audit interviews in resolving inconsistencies and revealing concealed facts (Bierstaker et al., 2006; Hamdan, 2018). In the Nigerian public sector, experts confirm investigative interviewing as a core component of anti-corruption investigations (Mukoro, 2013; Gbegi & Adebisi, 2014).

Evidence-Gathering and Litigation Techniques ensure that investigative findings are admissible in administrative and judicial proceedings. This includes maintaining chain of custody, preserving digital evidence, preparing expert-witness-ready reports and complying with evidentiary standards (Oyedokun & Emmanuel, 2015; Pasco, 2012). Studies emphasise that weak evidence handling is a major reason fraud cases fail in Nigerian courts (Oseni, 2017; Paramole, 2025).

Fraud investigation refers to a systematic and objective process of identifying, examining, and gathering evidence regarding suspected fraudulent activities with the aim of determining whether fraud has occurred, identifying the perpetrators, quantifying the extent of losses, and providing admissible evidence for legal or disciplinary actions. It involves the application of investigative techniques, forensic accounting procedures, data analysis, and interviewing methods to uncover intentional acts of deception, misrepresentation, or financial manipulation within organizations. Fraud investigation plays a crucial role in enhancing accountability, strengthening internal controls, and deterring future fraudulent practices in both public and private institutions (Albrecht et al., 2020; Singleton & Singleton, 2010).

2.2 Theoretical Review

This study integrates three theoretical perspectives: the Fraud Hexagon Theory, Agency Theory and Deterrence Theory.

2.2.1 Fraud Hexagon Theory

The Fraud Hexagon Theory was proposed by Georgios L. Vousinas in 2019 as an extension of earlier fraud theories. It built on the Fraud Triangle developed by Donald Cressey in 1953, the Fraud Diamond introduced by David T. Wolfe and Dana R. Hermanson in 2004, and the Fraud Pentagon advanced by Jonathan Marks in 2012. The theory posits that fraud is driven by six elements: pressure, opportunity, rationalization, capability, arrogance, and collusion. Vousinas' position was that collusion should be recognized as a distinct factor because many complex fraud schemes involve cooperation among multiple individuals, making detection and prevention more difficult. The Fraud Hexagon Theory is highly relevant to the study on the effects of forensic accounting techniques on fraud investigation effectiveness in Plateau State MDAs (Ministries, Departments, and Agencies). The six elements of the theory explain the conditions that facilitate fraudulent activities within public institutions, while forensic accounting techniques such as data analysis, forensic auditing, digital investigation, and litigation support help investigators identify evidence of opportunity, capability, and collusion among perpetrators. Consequently, the theory provides a useful framework for understanding how forensic accounting enhances fraud detection, uncovers concealed schemes, strengthens investigations, and improves the overall effectiveness of fraud control mechanisms in Plateau State MDAs.

2.2.2 Agency Theory

Agency Theory originated from the work of Stephen Ross (1973), who first analyzed the principal-agent relationship, and was later developed comprehensively by Michael Jensen and William Meckling in 1976. The theory explains that conflicts of interest arise when principals (owners, citizens, or government authorities) delegate responsibilities to agents (managers, public officials, or administrators) whose objectives may differ from those of the principals. Jensen and Meckling (1976) argued that because agents often possess more information than principals, information asymmetry can create opportunities for self-serving behavior, including fraud, corruption, misappropriation of assets, and financial misreporting. The theory therefore advocates for monitoring, control mechanisms, and accountability systems to reduce agency costs and align the interests of agents with those of principals. In the context of the effects of forensic accounting techniques on fraud investigation effectiveness in Plateau State MDAs (Ministries, Departments, and Agencies), Agency Theory provides a relevant theoretical foundation. Public officials entrusted with managing government resources act as agents on behalf of citizens and government authorities, who are the principals. Due to

information asymmetry and weak oversight, some officials may engage in fraudulent activities that are difficult to detect through conventional auditing procedures. Forensic accounting techniques such as data mining, digital forensic analysis, investigative auditing, and litigation support serve as monitoring and control tools that help uncover fraudulent schemes, provide credible evidence, and enhance accountability. Consequently, the application of forensic accounting techniques reduces agency problems by improving fraud detection and investigation effectiveness, thereby promoting transparency, stewardship, and public trust in Plateau State MDAs.

2.2.3 Deterrence Theory

Deterrence Theory originated in the classical school of criminology and is commonly associated with Cesare Beccaria, whose 1764 work *On Crimes and Punishments* argued that individuals are rational actors who weigh the costs and benefits of their actions before committing crimes. Beccaria maintained that punishment should be certain, swift, and proportionate to discourage unlawful behavior. The theory was further developed by Jeremy Bentham in 1789 through his utilitarian philosophy, which emphasized that people seek pleasure and avoid pain. Bentham argued that effective sanctions increase the perceived costs of wrongdoing, thereby reducing the likelihood of criminal acts. The central position of Deterrence Theory is that crime can be prevented when the risk of detection and punishment outweighs the expected benefits of the offense. In relation to the effects of forensic accounting techniques on fraud investigation effectiveness in Plateau State MDAs (Ministries, Departments, and Agencies), Deterrence Theory provides a useful explanatory framework. Forensic accounting techniques such as data analysis, fraud risk assessment, digital forensic investigation, and evidence-based auditing enhance the likelihood of detecting fraudulent activities and identifying perpetrators. As the certainty of detection and prosecution increases, public officials and employees are less likely to engage in fraudulent practices because they perceive a higher risk of exposure and punishment. Therefore, the application of forensic accounting techniques not only improves the effectiveness of fraud investigations but also serves as a preventive mechanism by deterring potential fraudsters within Plateau State MDAs.

Together, these theories provide a coherent explanation of how forensic techniques suppress the structural, psychological and systemic conditions that enable fraud and enhance fraud investigation outcomes.

2.3 Empirical Review

In the study relationship between coercive pressure and the use of forensic accounting services to detect and prevent fraud in public sector, Abatcha et al., (2025) investigated factors influencing the adoption of forensic accounting services in selected Nigerian MDAs. The study utilized a survey research design and collected data through structured questionnaires administered to public sector officials. Data analysis involved regression and correlation techniques. The results revealed that regulatory pressure and institutional demands significantly encourage the use of forensic accounting services, which subsequently improve fraud detection and prevention effectiveness. The study concluded that forensic accounting services are essential tools for combating fraud in the public sector. The relevance of this study to the present research lies in its focus on MDAs and its confirmation that forensic accounting techniques contribute positively to fraud investigation effectiveness.

In their study titled the role of forensic accounting in fraud detection and prevention in Nigerian Public Sector: A Case Study of Lagos, Nigeria, Ogbaini et al., (2024) examined the impact of forensic accounting on fraud detection and prevention within the Lagos State public

sector. The study adopted a survey research design and collected data from public sector employees involved in financial management and auditing activities. Statistical analyses were employed to determine the relationship between forensic accounting practices and fraud control. The findings revealed that forensic accounting significantly enhances fraud detection and prevention by improving investigative procedures and strengthening internal controls. The authors concluded that the adoption of forensic accounting techniques increases the effectiveness of fraud investigations in public institutions. This study is related to the present research because it demonstrates the usefulness of forensic accounting techniques in enhancing fraud investigation outcomes within government establishments, similar to the MDAs in Plateau State.

In the study *Forensic Accounting and Fraud Detection in Nigerian Public Sector: A Case Study of Rivers State, Ladi-Awofeso*, Clifford and Egbe (2023) investigated the effect of forensic accounting on fraud detection in public sector MDAs. Using a survey methodology, data were obtained from 357 accountants, directors, and senior staff selected through stratified random sampling. The researchers analyzed the data using Spearman Rank Correlation. Results indicated that forensic accounting competency, forensic accounting techniques, and proactive fraud audits significantly reduced payroll and procurement fraud. The study concluded that effective deployment of forensic accounting techniques improves fraud detection capabilities in government institutions. This study is directly relevant to the present research because it focuses on public sector MDAs and confirms that forensic accounting techniques contribute significantly to effective fraud investigation and detection.

The study titled *Forensic Accounting Investigation Techniques and Financial Crimes Reduction in Nigerian Public Sector: A Case Study of Anti-Graft Agencies (EFCC, ICPC and CCB) in Nigeria* was conducted by Mike, Okpe & Abu (2022). The researchers employed a survey design to examine how forensic investigation techniques influence the reduction of financial crimes in Nigeria's public sector. Data were collected from personnel of anti-corruption agencies and analyzed using inferential statistical methods. Findings showed that forensic accounting investigation techniques such as litigation support, financial investigation, and evidence gathering significantly reduce financial crimes and improve prosecution outcomes. The study concluded that forensic accounting tools strengthen the effectiveness of fraud investigations. This research is related to the current study because it provides empirical evidence that forensic accounting techniques improve investigative effectiveness, which is a major focus of the Plateau State MDA study.

In the study *Forensic Accounting and Fraud Management in Nigeria*, Eko (2022) evaluated the effectiveness of forensic accounting techniques in managing fraud within Nigerian public sector MDAs. The study employed a survey research design and focused on the application of data mining, accounting ratio analysis, and trend analysis as forensic accounting tools. Data were collected through questionnaires and analyzed statistically. Findings revealed that data mining, ratio analysis, and trend analysis significantly enhance the detection and prevention of fraudulent activities in government institutions. The study concluded that forensic accounting techniques are effective instruments for fraud management in the public sector. This study is closely related to the present research because it specifically examines forensic accounting techniques and their impact on fraud management within MDAs, thereby providing empirical support for investigating their effect on fraud investigation effectiveness in Plateau State.

3.0 METHODOLOGY

3.1 Research Design and Approach

The study adopted a descriptive–explanatory survey design to examine how forensic accounting techniques influence fraud investigation in Plateau State Ministries, Departments and Agencies (MDAs). This design was appropriate because it enabled both the description of existing investigative practices and the empirical analysis of the causal relationships between forensic accounting techniques and fraud investigation outcomes. Data were collected using a structured questionnaire administered to personnel directly involved in financial management, procurement oversight, internal control and investigative functions.

3.2 Population, Sampling and Response Rate

The population of the study is 132, targeting heads of Accounting and Audit units of sixty-six (66) Ministries, Departments and Agencies (MDAs) operating within Plateau State Public sector.

To determine an appropriate sample size, the study applied Taro Yamane's (1967) formula for finite populations at a 5 per cent level of precision. The formula is expressed as:

$$n = \frac{N}{1 + N(e)^2}$$

where:

n = sample size,

N = population size,

e = level of precision (0.05).

Substituting the relevant values:

$$\begin{aligned} n &= \frac{132}{1 + 132(0.05)^2} \\ n &= \frac{132}{1 + 132(0.0025)} \\ n &\approx 99 \end{aligned}$$

The computation indicates that a minimum of 99 to be randomly selected from 66 MDAs and administered the research questionnaire for statistical representativeness. Accordingly, respondent selection proceeded as follows:

- i. One Internal Audit officer was selected from each of the 66 sampled MDAs, yielding 66 respondents.
- ii. One director of finance was selected from each ministry and some bigger government board and agencies have both audit and accounting units

This produced a total of 99 copies of administered questionnaire.

Out of the 99 copies of the instrument distributed, only seventy-seven (77) were duly completed and returned, representing a response rate of 77.78 per cent. This response rate exceeds the minimum threshold commonly accepted for multivariate statistical analysis in forensic accounting and public sector governance research. The achieved rate provides adequate statistical power and reduces the risk of non-response bias.

All returned questionnaire were screened for completeness, logical consistency, and internal reliability prior to coding and analysis. The audit-centred sampling framework strengthens construct validity by ensuring that responses are drawn from officers with direct

responsibility for internal control monitoring, procurement review, and fraud detection, while the inclusion of the Auditor-General's Office enhances systemic representativeness and institutional depth.

This structured audit-focused design ensures that the study captures both operational-level internal assurance and state-level external oversight, thereby providing a robust empirical foundation for examining financial control effectiveness and fraud risk management across Plateau State MDAs

3.3 Instrumentation, Validity and Reliability

Primary data were collected using a structured, self-administered questionnaire divided into demographic information and six constructs: Computer-Assisted Audit Techniques (CAATs), Forensic Data Analytics (FDA), Document and Transaction Review Techniques (DRT), Investigative and Interview Techniques (INT), Evidence-Gathering and Litigation Techniques (EGT), and Fraud Investigation (FI). All construct items were measured on a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5).

Content validity was ensured through expert review by specialists in forensic accounting, auditing and public financial management. Reliability was assessed using Cronbach's Alpha, with all constructs meeting the acceptable threshold of 0.70, confirming internal consistency.

3.4 Operationalisation of Variables

The dependent variable, Fraud Investigation (FI), was operationalised using items that measured investigative timeliness, rigour, evidence quality, resolution outcomes and recurrence reduction.

The independent variables were operationalised as follows:

- i. CAATs: automated testing, anomaly detection, electronic data extraction
- ii. FDA: statistical analysis, predictive modelling, trend analysis, forensic analytics
- iii. DRT: document verification, third-party confirmation, tracing, reconciliation
- iv. INT: structured interviewing, deception detection, behavioural assessment
- v. EGT: chain of custody, digital evidence preservation, litigation-ready reporting

Composite scores were generated for each construct by averaging the respective item responses.

3.5 Method of Data Analysis

Data were analysed using descriptive statistics (means, standard deviations and frequencies) to summarise respondent characteristics and the extent of forensic technique utilisation. Inferential analysis was conducted using multiple regression to determine the effect of the five forensic accounting techniques on fraud investigation outcomes.

The model estimated was:

$$FI = \beta_0 + \beta_1 CAATs + \beta_2 FDA + \beta_3 DRT + \beta_4 INT + \beta_5 EGT + \varepsilon$$

Significance was assessed at the 5% level. Diagnostic tests were conducted to check for multicollinearity, normality and homoscedasticity to ensure model validity and robustness.

3.6 Ethical Considerations

Ethical approval was obtained prior to data collection. Participation was voluntary, anonymity was guaranteed, and no personal identifiers were recorded. Respondents were assured that the data would be used solely for academic purposes and treated with confidentiality.

4.0 RESULTS AND DISCUSSION

This section presents the empirical results derived from the survey of 77 officers drawn from 66 MDAs in Plateau State. The analysis integrates descriptive statistics, correlation diagnostics, and multivariate regression models to examine how forensic accounting techniques influence fraud investigation effectiveness. The results are interpreted through the theoretical lenses of the Fraud Hexagon, Agency Theory, and Deterrence Theory.

4.1 Descriptive and Correlation Analysis

The descriptive statistics show moderate levels of forensic accounting practice across MDAs, with CAATs (mean = 3.41) and DRT (mean = 3.49) emerging as the most frequently applied techniques. Investigative and interview techniques (INT) have the lowest utilisation (mean = 3.01), indicating potential capability gaps in behavioural inquiry and interrogation-based procedures. Fraud investigation effectiveness (FI) averages 3.12, suggesting that investigative outcomes remain only moderately satisfactory.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FI	77	3.117	.825	1	5
CAATs	77	3.414	1.018	1.2	5
FDA	77	3.265	1.079	1	5
DRT	77	3.488	.931	1.23	5
INT	77	3.012	1.169	1	5
EGT	77	3.209	.989	1.26	5

The correlation matrix demonstrates strong, positive associations between all forensic techniques and FI. CAATs ($r = 0.7735$), FDA ($r = 0.7553$), and INT ($r = 0.7714$) exhibit the strongest correlations, reflecting the interdependence of technological, analytical, and behavioural components of forensic practice. Inter-construct correlations (0.53–0.79) confirm conceptual coherence without unacceptable multicollinearity, consistent with the VIF results (mean VIF = 2.84). These early patterns suggest that MDAs with higher utilisation of forensic techniques also report better investigative outcomes.

Table 2: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) FI	1.000					
(2) CAATs	0.773	1.000				
(3) FDA	0.755	0.727	1.000			
(4) DRT	0.676	0.684	0.649	1.000		
(5) INT	0.771	0.764	0.785	0.705	1.000	
(6) EGT	0.647	0.587	0.670	0.527	0.675	1.000

4.2 Regression Results

4.2 Regression Results and Discussion

Table 2 presents the results of the robust multiple regression analysis examining the influence of forensic accounting techniques on fraud investigation effectiveness (FI) in Plateau State MDAs. The estimated model demonstrates strong explanatory power, with an R-squared value of 0.716, indicating that approximately 71.6 per cent of the variation in investigative

effectiveness is jointly explained by the five forensic techniques. The F-statistic ($F = 30.344$, $p < 0.001$) confirms that the model is statistically significant, thereby establishing the collective relevance of the explanatory variables.

Table 2: Linear regression (Robust)

FI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
CAuditorAATs	.255	.093	2.73	.008	.069	.441	***
FDA	.16	.078	2.06	.043	.005	.316	**
DRT	.107	.082	1.31	.196	-.056	.27	
INT	.139	.085	1.63	.108	-.031	.309	
EGT	.105	.065	1.60	.115	-.026	.235	
Constant	.597	.226	2.65	.01	.147	1.047	***
Mean dependent var		3.117	SD dependent var		0.825		
R-squared		0.716	Number of obs		77		
F-test		30.344	Prob > F		0.000		
Akaike crit. (AIC)		102.938	Bayesian crit. (BIC)		117.001		

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Author's own work

The robust specification further confirms the stability of the estimates in the presence of potential heteroskedasticity, thereby enhancing the reliability of the reported coefficients. The mean value of the dependent variable ($FI = 3.117$) reflects a moderately high level of perceived investigative effectiveness across sampled MDAs, while the standard deviation (0.825) indicates substantial institutional variation in investigative capacity.

Among the explanatory variables, Computer-Assisted Audit Techniques (CAATs) emerge as the strongest and most consistent predictor of fraud investigation effectiveness. The coefficient of 0.255 is positive and statistically significant at the 1 per cent level ($p = 0.008$), with a 95 per cent confidence interval that excludes zero. This finding indicates that improvements in the deployment of electronic audit tools, automated transaction screening systems, and digital trail reconstruction mechanisms are associated with significant enhancements in investigative outcomes. Substantively, this suggests that technology-driven oversight mechanisms play a central role in strengthening detection capacity and reducing concealment opportunities within public-sector organisations.

This result is theoretically consistent with Agency Theory, which posits that enhanced monitoring systems reduce information asymmetry and limit managerial opportunism. The deployment of CAATs strengthens principal oversight over agents by embedding surveillance within operational systems, thereby constraining discretionary manipulation. From the perspective of the Fraud Hexagon, CAATs weaken both the "opportunity" and "capability" dimensions by increasing the likelihood of exposure and diminishing perpetrators' technical advantage.

Forensic Data Analytics (FDA) also exerts a statistically significant positive effect on investigative effectiveness ($\beta = 0.160$, $p = 0.043$). Although smaller in magnitude than CAATs, the significance of FDA under robust estimation confirms the growing importance of analytical profiling, trend deviation analysis, and predictive anomaly detection in contemporary fraud investigations. This finding reflects the increasing reliance on data-driven intelligence to identify concealed financial irregularities within complex public-sector systems.

The significance of FDA reinforces emerging empirical evidence that modern fraud control increasingly depends on the capacity to interrogate large datasets systematically rather than relying on manual inspection. Within the theoretical framework, analytical techniques enhance deterrence by improving the perceived certainty of detection, which remains the most influential component of sanction-based compliance mechanisms. Moreover, FDA strengthens institutional learning by enabling investigators to detect recurring patterns and systemic vulnerabilities.

In contrast, Document Review Techniques (DRT), Investigative Interview Techniques (INT), and Evidence-Gathering Techniques (EGT), although positively signed, do not attain statistical significance at conventional levels. Their coefficients remain modest and their confidence intervals encompass zero, indicating limited independent explanatory power when technological and analytical tools are simultaneously considered.

The insignificance of these traditional techniques reflects several structural and operational constraints within MDAs. First, documentary reviews and manual verification processes are often insufficiently standardised and vulnerable to manipulation in environments characterised by weak record management systems. Second, much of their explanatory contribution overlaps with technologically enabled tools, resulting in diminished marginal effects once CAATs and FDA are controlled for. Third, capacity deficiencies in investigative interviewing and evidence handling, including limited legal training and weak documentation practices, constrain the operational effectiveness of these techniques.

These findings suggest that while traditional forensic methods remain institutionally embedded, their effectiveness is increasingly contingent on complementary technological support. Without robust digital infrastructure and analytical capability, manual investigative competencies struggle to produce measurable impact in complex fraud environments.

From a theoretical standpoint, the empirical pattern observed in Table 2 is strongly aligned with the study's integrated framework. Under the Fraud Hexagon, technology-intensive techniques primarily neutralise opportunity and capability, while traditional methods are less effective in addressing rationalisation and collusion dynamics. Agency Theory is validated through the dominant role of automated oversight mechanisms in constraining opportunistic behaviour. Deterrence Theory is reinforced by the significance of CAATs and FDA, which enhance the certainty and speed of detection, thereby strengthening compliance incentives.

Collectively, the results indicate that investigative effectiveness in Plateau State MDAs is driven predominantly by the depth of technological and analytical integration rather than by reliance on conventional investigative routines. The model's high explanatory power confirms that forensic capability is not merely a procedural function but a strategic institutional asset. The findings further reflect a structural transition in public-sector fraud control, whereby digital interrogation and analytics increasingly constitute the backbone of investigative systems. MDAs that prioritise investment in forensic technologies are better positioned to uncover sophisticated financial misconduct, while those dependent on manual procedures remain vulnerable to concealment strategies.

Overall, the evidence demonstrates that forensic accounting techniques significantly influence fraud investigation outcomes, but their impact is uneven across categories. Technology-led and data-driven methods constitute the principal drivers of investigative effectiveness, whereas traditional techniques function largely as supportive instruments. This imbalance underscores the need for a technology-centered forensic governance framework,

complemented by targeted capacity development in behavioural investigation and evidence management.

4.3 Post-Estimation Diagnostic Tests

To ensure the reliability and validity of the estimated regression model, post-estimation diagnostic tests were conducted to assess compliance with the assumptions of the classical linear regression framework. Specifically, tests for multicollinearity and heteroskedasticity were performed, with detailed statistical outputs reported in Appendix 2. Multicollinearity was examined using the Variance Inflation Factor (VIF), which produced values ranging from 2.04 to 3.82, with a mean of 2.84. These values fall well below conventional critical thresholds, indicating that intercorrelations among the explanatory variables are moderate and do not undermine the stability or interpretability of the estimated coefficients. The results therefore confirm that the forensic accounting techniques included in the model provide sufficiently distinct explanatory information and can be jointly retained without distorting statistical inference.

Heteroskedasticity was assessed using the Breusch–Pagan/Cook–Weisberg test, which yielded a chi-square statistic of 2.60 with a probability value of 0.1069 (see Appendix 2). Since this value exceeds the 5 per cent significance level, the null hypothesis of constant variance cannot be rejected, indicating that the residuals exhibit homoscedastic behaviour. Taken together, the diagnostic results confirm the adequacy and robustness of the estimated model. The absence of severe multicollinearity and significant heteroskedasticity suggests that the reported coefficients and standard errors are reliable and efficient. Consequently, the empirical relationships presented in Section 4.2 can be interpreted as stable, consistent, and reflective of the institutional dynamics shaping fraud investigation effectiveness within Plateau State MDAs.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study examined the effect of forensic accounting techniques on fraud investigation effectiveness in Ministries, Departments and Agencies (MDAs) in Plateau State, Nigeria. Drawing on data obtained from 77 respondents across selected MDAs, the empirical analysis revealed that forensic practices are applied at a moderate level within the public sector, with marked variation across technique categories. The results demonstrate that Computer-Assisted Audit Techniques (CAATs) and Forensic Data Analytics (FDA) exert statistically significant and economically meaningful effects on investigative effectiveness, thereby establishing technology-driven methods as the principal drivers of contemporary public-sector fraud control. The absence of statistical significance for Document Review Techniques, Investigative Interview Techniques, and Evidence-Gathering Techniques does not negate their institutional relevance. Rather, it reflects structural weaknesses in traditional investigative competencies, overlapping functional roles with digital tools, and persistent capacity constraints among public officers. These patterns are consistent with the Fraud Hexagon, Agency Theory, and Deterrence Theory, which collectively emphasise the role of advanced monitoring systems in reducing information asymmetry, constraining opportunism, and strengthening perceived detection certainty.

Overall, the study concludes that forensic accounting techniques are critical to fraud investigation outcomes, but their effectiveness is fundamentally shaped by the depth of digital integration, analytical sophistication, and professional competence within public institutions.

The evidence confirms that conventional audit mechanisms are insufficient in isolation and must be complemented by technology-enabled forensic systems supported by institutional reform and sustained human capital development.

5.2 Recommendations

In view of the empirical findings, several policy and operational recommendations are advanced. First, Plateau State should institutionalise the use of Computer-Assisted Audit Techniques and forensic analytics across all MDAs through mandatory deployment of transaction monitoring systems, audit interrogation software, and automated exception reporting platforms, supported by clear operational guidelines and periodic performance reviews.

Second, investigative capacity in traditional forensic methods should be strengthened through structured training in interviewing, evidence documentation, digital chain-of-custody management, and document validation, aligned with internationally recognised professional standards.

Third, a dedicated forensic investigation unit should be established within the State public service, staffed with specialised forensic accountants, data analysts, and digital examiners, to undertake high-risk audits and support internal anti-corruption processes.

Fourth, internal control frameworks should be enhanced with analytics-driven early-warning systems capable of detecting transactional anomalies and behavioural risk patterns in real time.

Fifth, institutional synergy among finance, procurement, internal audit, and investigation units should be promoted through integrated reporting structures, joint training programmes, and shared digital investigative platforms.

Sixth, regulatory and policy frameworks should be updated to formally incorporate forensic accounting standards into procurement regulations, financial management manuals, and audit guidelines, including mandatory electronic record retention and digital trail documentation.

Seventh, continuous professional development in data analytics, cyber-forensics, and behavioural investigation should be prioritised through partnerships with professional bodies such as ICAN, ANAN, and specialised anti-corruption training institutions.

5.3 Limitations and Directions for Future Research

Notwithstanding its contributions, the study is subject to certain limitations. The reliance on perceptual survey data introduces the possibility of self-reporting and social desirability bias. Future studies could incorporate forensic case records, digital transaction datasets, and investigative reports to enhance objectivity and methodological triangulation. Expanding the scope of analysis to multiple states or federal MDAs would improve generalisability. Further research may also examine the moderating effects of organisational culture, ethical climate, leadership quality, and digital maturity on the relationship between forensic accounting practices and fraud investigation outcomes.

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