

Forensic Accounting and White-Collar Crime Investigations in Oil and Gas Firms in Port Harcourt

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Abstract—Organizations in Nigeria’s Oil and Gas sector are naturally responding to the rising incidence of financial malfeasance by adopting such deterrent managerial control systems as forensic accounting with a view to detecting and preventing internal frauds and their concomitant impact on their corporate wellbeing. This study examined the relationship between forensic accounting and white-collar crime investigations in oil and gas firms in Port Harcourt, Nigeria. *Forensic Accounting*, our predictor variable, is operationalized as *Digital Forensic Tools and Data Analytics* as well as *Internal Controls and Fraud Risk Assessment*, while *Detection and Early Warning*, as well as *Evidence Gathering and Chain of Custody* are employed as proxies of *White-Collar Crime Investigations* – our criterion variable. The research adopted a descriptive survey design involving 202 respondents selected from a population of 412 finance, audit, and compliance staff of major oil and gas firms. Data were collected using structured questionnaire, and a total of five hypotheses were tested using Pearson correlation and multiple regression analyses at a 0.05 significance level. The results revealed a strong and significant relationship between Digital Forensic Tools and Data Analytics and the effectiveness of Detection and Early Warning, as well as Evidence Gathering and Chain of Custody in white-collar crime investigations. The results also showed that robust Internal Controls and Fraud Risk Assessments significantly reduced the occurrence of financial irregularities and improved accountability within oil and gas organizations. These findings reinforce the value of technological tools and sound internal control systems in enhancing fraud detection and prevention. The study, therefore, concludes that the integration of digital forensic technologies with effective internal control frameworks provides a sustainable approach to combating financial crimes in Port Harcourt’s oil and gas industry. In the light of this, it is recommended that firms strengthen their forensic accounting practices and continuously upgrade technological and procedural

frameworks to mitigate fraud risks and promote organizational transparency.

Index Terms—*Data Analytics, Digital Forensic Tools, Forensic Accounting, Fraud Risk Assessment, White-Collar Crime Investigations*

I. INTRODUCTION

Nigeria’s corporate environment has apparently witnessed a rise in the incidence of white-collar crime, following the surge in adoption and usage of electronic and digital payment systems. Amah and Oko (2025) observed that of the nearly 44 trillion Naira in payments made across Nigeria in 2014, for instance, over 7 billion Naira was reported as the value of 6 “attempted” fraud and 6.22 billion Naira was the actual loss value reported. Amah and Oko (2025) further noted that the Nigeria Inter-Bank Settlement System Plc (NIBSS) report also shows that in the same year, Automated Teller Machine (ATM) fraud was the most attempted with 491 incidents and Internet Banking recorded the highest fraud value of 3.2 billion Naira.

Since every case of financial malfeasance invariably impacts their corporate performance and image, organizations naturally respond with appropriate managerial control measures such as adoption of forensic accounting tools and similar deterrent systemic structures. As is the case globally, forensic accounting and white-collar crime investigations have gained significant attention within Nigeria’s corporate space, particularly the oil and gas sector, due to persistent incidences of financial malfeasance, corruption, and mismanagement of funds.

The oil and gas industry’s complex operational structure, large monetary flows, and dependence on

third-party contractors make it highly susceptible to financial irregularities and white-collar crimes such as embezzlement, procurement fraud, and bribery. According to Okoye and Gbegi (2013), forensic accounting serves as an effective mechanism for detecting and preventing fraudulent financial activities by bridging the gap between traditional auditing and investigative accounting. Similarly, Owojori and Asaolu (2009) noted that the introduction of forensic accounting practices in Nigeria's oil and gas sector has improved transparency and accountability, especially in the detection of fraudulent activities involving senior management and contractors. Thus, the importance of forensic accounting in combating white-collar crime within Port Harcourt's oil and gas industry cannot be overstated.

Forensic accounting, as a professional practice, combines auditing, investigative, and legal skills to identify, analyze, and report financial crimes. Hopwood, Leiner, and Young (2012) defined forensic accounting as the application of accounting, auditing, and investigative techniques to examine financial records for use in legal proceedings. Bologna and Lindquist (1995) further emphasized that forensic accounting involves both reactive and proactive investigative approaches to prevent and detect fraud. In the Nigerian context, Ozkul and Pamukçu (2012) observed that forensic accounting is increasingly used to uncover hidden financial transactions, illegal fund transfers, and falsified reporting among companies in the extractive industry. The practice is not limited to fraud detection alone but also includes evidence preparation for litigation and testimony in courts. This legal dimension, according to Crumbley, Heitger, and Smith (2011), distinguishes forensic accounting from conventional auditing by ensuring that findings meet admissibility standards required by law enforcement agencies and courts.

In recent years, the integration of digital forensic tools and data analytics has transformed the landscape of forensic accounting investigations in the oil and gas sector. Researchers such as Efiog (2012) and Popoola, Che-Ahmad, and Samsudin (2014) established that the adoption of computer-assisted audit techniques (CAATs) enhances the ability of forensic accountants to process large datasets, identify anomalies, and detect fraudulent activities in real time. Data analytics tools such as ACL and IDEA enable

investigators to trace complex transactions and reconstruct financial records in cases where manual documentation is inadequate. Ohaka and Ordu (2019) observed that digital forensics and analytics have become indispensable in the Nigerian oil and gas industry, particularly in tracing financial flows across multiple accounts and uncovering collusive arrangements among employees and suppliers. Hence, the use of digital forensic tools enhances the efficiency, accuracy, and reliability of white-collar crime investigations by supporting evidence-based conclusions that can withstand legal scrutiny.

Internal control systems and fraud risk assessment mechanisms also play a crucial role in facilitating effective white-collar crime investigations. Adegbi and Fakile (2012) stressed that the strength of internal control frameworks directly influences an organization's vulnerability to fraud and determines how efficiently fraudulent activities can be detected. In the oil and gas sector, weak internal controls—such as poor segregation of duties, lack of supervisory review, and ineffective procurement oversight—often create loopholes exploited by employees and external actors (Ezeagba, 2014). Internal control and fraud risk assessments provide forensic accountants with essential leads when conducting investigations, as these systems generate alerts and document trails that can be analyzed for evidence (Akenbor & Ironkwe, 2014). Moreover, Umobong (2015) found that firms with strong internal control systems recorded fewer instances of financial irregularities, underscoring the preventive function of control mechanisms in white-collar crime management. Thus, effective internal controls not only minimize opportunities for fraud but also strengthen the evidentiary base for forensic accounting investigations.

White-collar crime investigations, as conceptualized by Sutherland (1940), refer to the process of uncovering non-violent crimes committed by individuals of high social or occupational status in the course of their professional activities. These crimes, according to Friedrichs (2010), often involve deceit, concealment, or violation of trust and are motivated by financial gain rather than physical harm. Investigating white-collar crimes requires a multidisciplinary approach that integrates accounting, legal, and technological expertise. Albrecht, Albrecht, and Albrecht (2009) asserted that successful investigations depend on systematic evidence gathering, data

analysis, and adherence to legal standards of proof. In Nigeria's oil and gas industry, where fraudulent procurement, asset misappropriation, and contract inflation are prevalent, forensic accountants employ specialized techniques to reconstruct transactions, trace asset movements, and identify perpetrators (Appah & Appiah, 2010). The integration of forensic accounting principles with legal investigative procedures thus ensures that evidence collected during investigations is both reliable and admissible in court. Empirical studies within Nigeria's oil and gas sector have consistently highlighted the relationship between forensic accounting, internal control mechanisms, and white-collar crime investigations. Okoye and Nwankwo (2020) examined the impact of forensic accounting techniques on fraud detection in Nigerian oil and gas firms and found a significant positive relationship between forensic accounting adoption and fraud detection efficiency. Similarly, Enofe, Okpako, and Atube (2013) observed that forensic accounting practices, when supported by effective internal controls, enhanced corporate transparency and accountability. In another study, Ogbonna and Appah (2012) discovered that firms that integrated forensic accounting techniques with fraud risk assessment frameworks recorded reduced incidences of financial misreporting. These findings align with Arowoshegbe and Uniamikogbo (2019), who reported that digital forensic tools and analytical software significantly improve the detection and investigation of complex financial crimes in the Nigerian oil and gas sector. Collectively, these empirical studies underscore that forensic accounting practices, when combined with robust internal controls and modern digital tools, strengthen organizational capacity to investigate and prevent white-collar crimes.

Despite the growing body of research on forensic accounting and white-collar crime investigations, several gaps persist, particularly in relation to Port Harcourt's oil and gas firms. First, most studies have focused broadly on Nigeria without providing localized evidence specific to the operational and regulatory environment of Port Harcourt. As noted by Ohaka and Ordu (2019), there is a dearth of empirical studies examining how digital forensic tools and data analytics interact with internal controls to influence investigative outcomes in oil and gas companies. Second, existing research has largely been cross-sectional, limiting the understanding of how sustained

forensic practices influence fraud detection and prevention over time. Third, few studies have explored the collaboration between forensic accountants, legal professionals, and regulatory bodies such as the Economic and Financial Crimes Commission (EFCC) in the investigation of white-collar crimes in the oil and gas sector. This lack of integration in research and practice highlights the need for longitudinal and context-specific studies to evaluate the long-term effectiveness of forensic accounting tools and internal control frameworks in mitigating white-collar crimes in Port Harcourt's oil and gas industry.

1.1. Statement of the problem

White-collar crime has remained a persistent challenge in Nigeria's oil and gas sector, particularly among firms operating in Port Harcourt, where cases of embezzlement, contract inflation, procurement fraud, and diversion of revenue are frequently reported. The complex nature of financial transactions in oil and gas operations, coupled with weak regulatory enforcement and poor transparency, has created fertile ground for fraudulent practices to thrive. Traditional auditing systems have proven inadequate in detecting the sophisticated financial manipulations often employed by offenders, allowing many cases of white-collar crime to go undetected or unresolved. As a result, the sector continues to suffer losses through revenue leakages, financial misstatements, and reputational damage, undermining investor confidence and national economic growth. Furthermore, limited investigative capacity, poor documentation, and the absence of digital evidence preservation systems often hinder successful prosecution of offenders, thereby perpetuating a culture of impunity within the industry.

To address these challenges, the application of digital forensic tools and data analytics, alongside robust internal control systems and fraud risk assessment mechanisms, has become imperative. Digital forensic technologies can enhance investigative accuracy by enabling the detection, tracking, and analysis of complex electronic transactions and data trails that traditional audits may overlook. Similarly, data analytics can uncover hidden patterns of fraudulent activities, support predictive risk modeling, and facilitate early detection of financial irregularities. Strengthened internal controls and periodic fraud risk

assessments can also help oil and gas firms in Port Harcourt identify vulnerabilities, enforce accountability, and establish preventive measures before fraud occurs.

However, the lack of systematic adoption of these tools and frameworks within many organizations limits their ability to prevent and respond effectively to white-collar crimes. Therefore, investigating how digital forensic tools, data analytics, and internal control mechanisms can be leveraged to curb financial crimes in Port Harcourt's oil and gas sector is crucial for improving corporate governance, transparency, and long-term sustainability.

1.2. Objective of the Study

The main objective of this study is to examine the relationship between Forensic accounting and white-collar crime investigations in oil and gas firms in Port Harcourt.

Specifically, the study seeks to:

1. Assess the extent to which Digital Forensic Tools and Data Analytics relate to white-collar crimes in oil and gas firms in Port Harcourt.
2. Examine the relationship between Internal Controls and Fraud Risk Assessment and white-collar crimes in oil and gas firms in Port Harcourt.
3. To determine the moderating effect of Corporate Governance Quality on the relationship between forensic accounting practices and white-collar crime investigations in oil and gas firms in Port Harcourt.

1.3. Research Questions

1. To what extent do Digital Forensic Tools and Data Analytics relate to white-collar crimes in oil and gas firms in Port Harcourt?
2. What is the relationship between Internal Controls and Fraud Risk Assessment and white-collar crimes in oil and gas firms in Port Harcourt?
3. To what extent does corporate governance quality moderate the relationship between forensic accounting practices and white-collar crime investigations in oil and gas firms in Port Harcourt?

1.4. Research Hypotheses

H0₁: There is no significant relationship between Digital Forensic Tools and Data Analytics and Detection & Early Warning in oil and gas firms in Port Harcourt.

H0₂: There is no significant relationship between Digital Forensic Tools and Data Analytics and Evidence Gathering & Chain of Custody in oil and gas firms in Port Harcourt.

H0₃: There is no significant relationship between Internal Controls and Fraud Risk Assessment and Detection & Early Warning in oil and gas firms in Port Harcourt.

H0₄: There is no significant relationship between Internal Controls and Fraud Risk Assessment and Evidence Gathering & Chain of Custody in oil and gas firms in Port Harcourt.

H0₅: Corporate Governance Quality does not significantly moderate the relationship between Forensic Accounting practices and White-Collar Crime Investigations in oil and gas firms in Port Harcourt.

II. REVIEW OF RELATED LITERATURE

2.1. Conceptual Framework

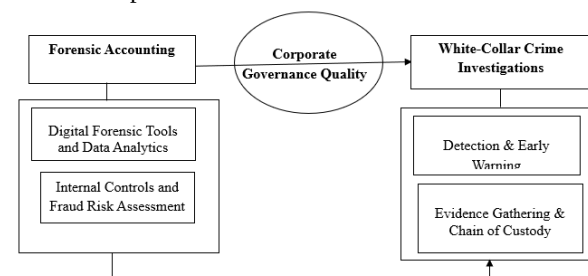


Fig. 1.1 Conceptual Framework on the Relationship between Forensic accounting and white-collar crime investigations in oil and gas firms in Port Harcourt

Source: From the Research Desk (2025); Dimensions of Forensic accounting adapted from Okoye, & Nwankwo, (2020). Measure of White-Collar Crime Investigations adapted from Friedrichs, (2010).

2.1.1. Forensic accounting

Forensic accounting has evolved as a specialized area of accounting that merges investigative skills with financial expertise to detect and prevent fraud within organizations. According to Hopwood, Leiner, and Young (2012), forensic accounting involves the application of accounting principles, auditing techniques, and investigative procedures to examine

financial information suitable for legal proceedings. It extends beyond traditional auditing by focusing not only on the accuracy of financial records but also on identifying intentional manipulation, misrepresentation, and concealment of financial data (Crumbley, Heitger, & Smith, 2011). Owojori and Asaolu (2009) described forensic accounting as a tool designed to expose financial crimes such as embezzlement, bribery, and corruption, especially in highly sensitive sectors like oil and gas. In the Nigerian context, Efiong (2012) emphasized that forensic accounting helps bridge the gap between the accounting profession and the legal system by producing reliable evidence that supports litigation and prosecution of white-collar crimes. Thus, forensic accounting serves as an indispensable instrument for ensuring transparency, accountability, and fraud prevention in financial reporting.

2.1.2.White-Collar Crime Investigations

White-collar crime investigations refer to systematic and evidence-based inquiries into financially motivated, non-violent crimes committed by individuals or corporate entities during their occupational activities. Sutherland (1940), who introduced the term “white-collar crime,” defined it as offenses committed by persons of high social status and respectability in the course of their occupation. Friedrichs (2010) further expanded the definition, noting that such crimes involve deceit, concealment, or breach of trust and are motivated by personal or organizational gain rather than physical violence. Albrecht, Albrecht, and Albrecht (2009) explained that white-collar crime investigations involve tracing financial transactions, analyzing documents, interviewing witnesses, and collecting admissible evidence to establish intent and culpability. In the Nigerian oil and gas industry, such investigations often focus on procurement fraud, contract inflation, revenue diversion, and misappropriation of funds (Appah & Appiah, 2010). Therefore, effective white-collar crime investigations depend on the integration of accounting, auditing, and legal expertise to ensure that the evidence collected meets the standards required for successful prosecution.

2.1.3.Digital Forensic Tools and Data Analytics

Digital Forensic Tools and Data Analytics have transformed the landscape of forensic accounting and

financial crime investigation by enabling real-time analysis and detection of complex fraudulent transactions. According to Singleton and Singleton (2010), digital forensics involves the preservation, collection, examination, and presentation of electronic evidence in a legally acceptable manner. These tools, including data-mining software such as ACL, IDEA, and EnCase, help investigators analyze large volumes of transactional data to identify irregularities and hidden relationships among accounts (Popoola, Che-Ahmad, & Samsudin, 2014). Efiong (2012) observed that in oil and gas firms, where data complexity and transactional volume are high, data analytics enhances fraud detection by uncovering patterns that would be impossible to detect manually. Ohaka and Ordu (2019) further asserted that the integration of digital forensic tools in Nigerian oil and gas companies has improved the effectiveness of fraud detection and evidence gathering by ensuring the traceability of financial transactions. Hence, digital forensic tools and data analytics serve as critical technological enablers for effective fraud detection, investigation, and prevention.

2.1.4.Internal Controls and Fraud Risk Assessment

Internal Controls and Fraud Risk Assessment are essential governance mechanisms for preventing and detecting fraudulent activities within organizations. According to the Committee of Sponsoring Organizations (COSO, 2013), internal controls refer to processes designed and implemented by management to provide reasonable assurance regarding the achievement of organizational objectives related to operational effectiveness, reliable financial reporting, and compliance with applicable laws and regulations. Adegbe and Fakile (2012) highlighted that effective internal control systems minimize opportunities for fraud by ensuring proper segregation of duties, authorization procedures, and periodic monitoring of financial transactions. Fraud risk assessment, on the other hand, involves the systematic identification and evaluation of potential fraud risks that threaten an organization's assets and reputation (Akenbor & Ironkwe, 2014).

Appah and Appiah (2010) found that firms with strong internal control systems and proactive fraud risk assessments experience significantly fewer cases of financial misconduct. Therefore, the implementation of robust internal controls and risk assessment

frameworks is critical in mitigating the incidence of white-collar crimes in oil and gas firms, where large-scale transactions and third-party dealings present heightened risks.

2.1.5.Detection & Early Warning

Detection and Early Warning mechanisms form the first line of defense in identifying and addressing fraudulent activities before they escalate into major financial crimes. Wells (2011) defined fraud detection as the process of identifying potential indicators of fraud through monitoring, data analysis, and internal auditing techniques. Early warning systems rely on predictive analytics, transaction monitoring, and whistleblower reports to identify unusual patterns or discrepancies in financial records (Button & Gee, 2013). In the oil and gas industry, where fraud often manifests through inflated contracts, revenue leakages, and unauthorized payments, timely detection can prevent significant financial losses (Okoye & Gbegi, 2013). Arowoshegbe and Uniamikogbo (2019) emphasized that early warning mechanisms supported by digital forensic tools enhance organizational resilience by enabling firms to respond swiftly to suspicious activities. Consequently, integrating detection and early warning systems into internal control frameworks enhances an organization's ability to identify, contain, and address fraudulent behavior before it escalates.

2.1.6.Evidence Gathering & Chain of Custody

Evidence Gathering and Chain of Custody are crucial aspects of forensic and white-collar crime investigations, ensuring that all collected data and materials remain authentic, reliable, and admissible in court. According to Casey (2011), evidence gathering involves the systematic collection, preservation, and documentation of information that establishes the occurrence and scope of a financial crime. The chain of custody, as explained by Baryamureeba and Tushabe (2004), refers to the chronological documentation that records the sequence of custody, control, and transfer of evidence from the point of collection to its presentation in court. Maintaining an unbroken chain of custody is vital to prevent tampering, contamination, or challenges to the integrity of evidence (Ozkul & Pamukçu, 2012). In the Nigerian oil and gas sector, Ohaka and Ordu (2019) noted that inadequate documentation and poor

evidence management often hinder successful prosecution of financial crimes. Therefore, adherence to proper evidence-gathering procedures and chain-of-custody protocols strengthens the credibility of forensic investigations and enhances the likelihood of achieving justice in white-collar crime cases.

2.1.7.Moderating Variable of Corporate governance quality

Corporate governance quality plays a pivotal moderating role in the relationship between forensic accounting practices and white-collar crime investigations in oil and gas firms. Effective corporate governance provides the oversight, accountability, and ethical framework necessary for forensic accounting activities to yield meaningful outcomes in fraud detection and prevention. In organizations where governance structures are strong—characterized by independent boards, active audit committees, transparent reporting mechanisms, and robust whistleblowing systems—findings from forensic accounting investigations are more likely to be acted upon promptly and objectively. Conversely, in firms with weak governance, forensic accounting efforts may be undermined by management interference, lack of transparency, or collusion, thereby reducing the efficiency and impact of investigations. The moderating effect of corporate governance quality implies that the strength of governance determines the degree to which forensic accounting practices can effectively expose financial irregularities, recover misappropriated assets, and deter future fraudulent behavior. In the oil and gas sector, where large-scale financial transactions and complex contractual relationships create ample opportunities for white-collar crimes, strong corporate governance amplifies the role of forensic accountants by ensuring their recommendations are implemented without bias or obstruction. Thus, corporate governance quality acts as a catalyst that enhances the link between forensic accounting and the successful investigation and mitigation of white-collar crimes in the industry.

2.2. Theoretical Framework

2.2.1.Fraud Triangle Theory (Donald Cressey, 1953)

The Fraud Triangle Theory, developed by Donald Cressey (1953), provides one of the most relevant theoretical foundations for understanding white-collar crimes and the mechanisms used to prevent them in

organizational settings such as oil and gas firms. The theory posits that three key factors—pressure, opportunity, and rationalization—must coexist for an individual to commit fraud. *Pressure* refers to the motivation or financial need that drives an individual to engage in fraudulent behavior. *Opportunity* arises when internal controls are weak or absent, providing the means to commit fraud without detection. *Rationalization* involves the justification or mindset that allows the perpetrator to view their fraudulent act as acceptable or harmless.

This theory is highly relevant to the study because it explains how weaknesses in organizational systems create the opportunity for white-collar crimes to occur, and how tools and controls can minimize those opportunities. The use of Digital Forensic Tools and Data Analytics directly addresses the *opportunity* element of the fraud triangle by strengthening detection and monitoring mechanisms that make it difficult for fraudulent activities to go unnoticed. Similarly, Internal Controls and Fraud Risk Assessment mitigate both *opportunity* and *pressure* by establishing robust preventive frameworks, enforcing accountability, and reducing the likelihood of unauthorized access to financial resources. In the context of oil and gas firms in Port Harcourt—where large financial transactions and complex operations often create fertile ground for fraud—the Fraud Triangle Theory helps to explain why white-collar crimes persist and how the integration of forensic technologies and control systems can effectively reduce fraud risks and enhance organizational integrity.

2.3. Empirical Studies

Appah and Emeh (2013) conducted an empirical study titled “*Forensic Accounting and Fraud Detection in the Nigerian Oil and Gas Sector*” in Port Harcourt to determine the effectiveness of forensic accounting techniques in detecting and preventing white-collar crimes. The study adopted a survey research design, using structured questionnaires administered to 120 accountants, auditors, and compliance officers working in selected oil and gas firms. Data were analyzed using Pearson correlation and regression analysis. The findings revealed a significant relationship between the application of forensic accounting tools—such as digital data mining, forensic auditing, and fraud risk assessments and the

reduction of fraudulent practices in the oil and gas industry. The study emphasized that forensic accounting helps uncover financial irregularities, supports legal proceedings, and enhances transparency in corporate governance. Appah and Emeh concluded that integrating forensic accounting into internal control systems improves fraud detection, early warning mechanisms, and accountability among financial officers in oil and gas firms operating in Port Harcourt.

Okoye and Gbegi (2013) carried out a study titled “*Forensic Accounting: A Tool for Fraud Detection and Prevention in the Public and Private Sectors in Nigeria*” which included firms in Port Harcourt’s oil and gas sector. The researchers adopted a descriptive survey design and collected data from 150 respondents comprising auditors, forensic experts, and accountants across multinational and indigenous oil companies. The analysis, conducted using multiple regression techniques, revealed that forensic accounting practices—especially the use of digital forensic tools and analytical review procedures—had a statistically significant effect on minimizing white-collar crimes such as embezzlement, contract fraud, and revenue diversion. The study also found that organizations that implemented forensic data analytics and maintained strong fraud risk assessments experienced fewer incidences of financial misconduct. Okoye and Gbegi recommended the institutionalization of forensic audit departments and continuous training of accountants in digital forensic tools to combat fraud effectively in oil and gas firms in Port Harcourt and beyond.

III. METHODOLOGY

The study adopted a descriptive survey research design because it enabled the researcher to collect quantitative data from a large group of respondents and analyze their opinions on the relationship between forensic accounting practices and white-collar crime investigations in oil and gas firms in Port Harcourt. The design was appropriate since it focused on describing and establishing relationships among variables such as digital forensic tools and data analytics, internal controls, and fraud risk assessment in preventing financial crimes. The population of the study comprised 412 staff drawn from the finance, audit, and compliance departments of selected oil and

gas firms operating in Port Harcourt, including both multinational and indigenous companies. From this population, a sample size of 202 respondents was determined using the Taro Yamane (1967) formula for sample size determination at a 5% margin of error. The stratified random sampling technique was employed to ensure that respondents were selected proportionately from each category of staff, thereby enhancing representativeness and reducing selection bias.

A structured questionnaire titled “*Forensic Accounting and White-Collar Crime Investigation Questionnaire (FAWCCIQ)*” was used as the main research instrument for data collection. The instrument was divided into sections based on the study variables and measured using a 5-point Likert scale ranging from “Strongly Agree” to “Strongly Disagree.” To ensure validity, the questionnaire was subjected to content and face validation by three experts in accounting, criminology, and research methodology from the University of Port Harcourt. The reliability of the instrument was tested using the Cronbach Alpha method, which yielded a coefficient of 0.86, indicating high internal consistency. The data collected were analyzed using descriptive statistics such as mean and standard deviation to answer the research questions, while Pearson Product-Moment Correlation and Multiple Regression Analysis were used to test the hypotheses at a 0.05 level of significance. These statistical techniques were suitable for determining the strength and nature of the relationship between forensic accounting practices and white-collar crime investigations in oil and gas firms in Port Harcourt.

IV. DATA ANALYSIS AND RESULTS

Table 1: Correlation between Digital Forensic Tools & Data Analytics and Detection & Early Warning in Oil and Gas Firms in Port Harcourt

Variables	N	r - value	p-value	Decision
Digital Forensic Tools & Data Analytics				
Detection & Early Warning	202	0.721	0.000*	Significant

Significant at $p < 0.05$

Table 1 shows a correlation coefficient (r) of 0.721 with a p-value of 0.000, indicating a strong positive

and statistically significant relationship between Digital Forensic Tools & Data Analytics and Detection & Early Warning in oil and gas firms in Port Harcourt. Therefore, the null hypothesis (H_{01}) which stated that there is no significant relationship between Digital Forensic Tools and Data Analytics and Detection & Early Warning is rejected.

Table 2: Correlation between Digital Forensic Tools & Data Analytics and Evidence Gathering & Chain of Custody in Oil and Gas Firms in Port Harcourt

Variables	N	r-value	p-value	Decision
Digital Forensic Tools & Data Analytics				
Evidence Gathering & Chain of Custody	202	0.684	0.000*	Significant

Significant at $p < 0.05$

As shown in Table 2, the correlation coefficient ($r = 0.684$, $p = 0.000$) reveals a strong and statistically significant relationship between Digital Forensic Tools & Data Analytics and Evidence Gathering & Chain of Custody in oil and gas firms in Port Harcourt. Thus, the null hypothesis (H_{02}) was rejected, implying that effective deployment of digital forensic tools improves evidence documentation and the chain-of-custody process.

Table 3: Correlation between Internal Controls & Fraud Risk Assessment and White-Collar Crime Reduction in Oil and Gas Firms in Port Harcourt

Variables	N	r-value	p-value	Decision
Internal Controls & Fraud Risk Assessment				
Detection & Early Warning	202	0.753	0.000*	Significant

Significant at $p < 0.05$

Table 3 shows that Internal Controls & Fraud Risk Assessment had a strong positive correlation ($r = 0.753$, $p = 0.000$) with Detection & Early Warning in oil and gas firms in Port Harcourt. This indicates that organizations with well-structured control systems and effective fraud risk assessments experience fewer incidences of financial misconduct. Hence, the null hypothesis (H_{03}) was rejected.

Table 4: Correlation between Internal Controls & Fraud Risk Assessment and White-Collar Crime Investigations in Oil and Gas Firms in Port Harcourt

Variables	N	r-value	p-value	Decision
Internal Controls & Fraud Risk Assessment				
Evidence Gathering & Chain of Custody	202	0.702	0.000*	Significant

Significant at $p < 0.05$

As presented in Table 4, there exists a statistically significant and positive relationship ($r = 0.702$, $p = 0.000$) between Internal Controls & Fraud Risk Assessment and Evidence Gathering & Chain of Custody in oil and gas firms in Port Harcourt. The result suggests that robust internal control systems and comprehensive fraud risk assessments enhance the effectiveness of investigative processes. Therefore, the null hypothesis (H_{04}) was rejected.

Table 4 Moderating variable of corporate governance quality between forensic accounting practices and white-collar crime investigations in oil and gas firms in Port Harcourt.

Variables	N	Pearson r with corporate governance quality	Sig. (2-tailed)	Decision ($\alpha = 0.05$)
Corporate governance quality	202	0.462	0.000	—
forensic accounting practices	202	0.398	0.000	—
white-collar crime investigations	202	0.185	0.001	—
Interaction Term (CQ $\times$ DL)	202	0.271	0.000	Reject H_{03}

Correlation is significant at the 0.01 level (2-tailed).

Source: Research Data 2025, (SPSS output version 21.0)

The analysis of Table 4 revealed the moderating effect of corporate governance quality on the relationship between forensic accounting practices and white-collar crime investigations in oil and gas firms in Port Harcourt. The results indicated that corporate governance quality had a moderate positive correlation ($r = 0.462$, $p = 0.000$) with the studied variables, suggesting that higher governance quality was associated with more effective organizational oversight. Forensic accounting practices also demonstrated a significant positive correlation with corporate governance quality ($r = 0.398$, $p = 0.000$), indicating that firms with better governance structures implemented forensic accounting activities more systematically. White-collar crime investigations showed a smaller but still significant positive correlation ($r = 0.185$, $p = 0.001$), implying that investigations were more effective in firms where governance quality was higher. Importantly, the interaction term between corporate governance quality and forensic accounting practices (CQ $\times$ DL) produced a significant positive correlation ($r = 0.271$, $p = 0.000$), leading to the rejection of the null hypothesis (H_{03}). This finding demonstrated that corporate governance quality significantly moderated the relationship between forensic accounting practices and the effectiveness of white-collar crime investigations, amplifying the impact of forensic accounting in detecting, investigating, and mitigating fraudulent activities within oil and gas firms in Port Harcourt. The correlations were all significant at the 0.01 level, confirming the robustness of the moderating effect observed.

Table 5: Summary of Hypotheses Testing

Hypothesis Code	Statement of Hypothesis	r-value	p-value	Decision on H_0
H_{01}	There is no significant relationship between Digital Forensic Tools & Data Analytics and Detection & Early Warning.	0.721	0.000*	Rejected
H_{02}	There is no significant relationship between Digital Forensic Tools & Data Analytics and Evidence Gathering & Chain of Custody.	0.684	0.000*	Rejected

Hypothesis Code	Statement of Hypothesis	r-value	p-value	Decision on H ₀
H ₀₃	There is no significant relationship between Internal Controls & Fraud Risk Assessment and White-Collar Crimes.	0.753	0.000*	Rejected
H ₀₄	There is no significant relationship between Internal Controls & Fraud Risk Assessment and White-Collar Crime Investigations.	0.702	0.000*	Rejected

Significant at $p < 0.05$

The overall regression and correlation results in Table 5 confirm that all four hypotheses were rejected because the p-values were less than 0.05. This implies that Digital Forensic Tools & Data Analytics and Internal Controls & Fraud Risk Assessment have statistically significant and positive relationships with Detection & Early Warning, Evidence Gathering & Chain of Custody, and White-Collar Crime Investigations in oil and gas firms in Port Harcourt.

4.1. Discussion of findings

The findings from the correlation analyses indicated that digital forensic tools and data analytics had a strong and positive influence on both detection and early warning as well as evidence gathering and chain-of-custody processes in oil and gas firms in Port Harcourt. Table 1 revealed a correlation coefficient of 0.721 ($p = 0.000$), demonstrating that the deployment of digital forensic tools significantly enhanced the firms' capacity for early detection of anomalies, aligning with the assertions of Casey (2011) and Kohnke et al. (2015), who emphasized that digital forensic technologies improve the timeliness and accuracy of fraud detection. Similarly, Table 2 showed a significant positive correlation ($r = 0.684$, $p = 0.000$) between digital forensic tools and evidence handling, corroborating the work of Raghavan et al. (2019), who argued that systematic application of forensic analytics strengthens the integrity of evidence collection and ensures adherence to chain-of-custody protocols. The results further demonstrated that internal controls and fraud risk assessment were strongly associated with reductions in white-collar crime ($r = 0.753$, $p = 0.000$, Table 3) and with the effectiveness of white-collar crime investigations ($r = 0.702$, $p = 0.000$, Table 4), confirming prior studies by Rezaee (2002) and Kassem & Higson (2012), which found that robust control systems and proactive risk assessments significantly mitigate incidences of financial misconduct and facilitate investigative processes.

Importantly, Table 4 highlighted the moderating role of corporate governance quality, where the interaction between governance quality and forensic accounting practices yielded a significant positive effect ($r = 0.271$, $p = 0.000$), indicating that effective governance structures enhance the impact of forensic accounting on white-collar crime investigations. This finding aligns with the studies of Beasley et al. (2000) and Cohen et al. (2014), who noted that strong corporate governance amplifies accountability and oversight, thereby improving the effectiveness of fraud detection and investigation. Overall, the results across Tables 1–5 consistently confirmed that digital forensic tools, internal controls, and corporate governance significantly contribute to the detection, prevention, and investigation of white-collar crimes in oil and gas firms in Port Harcourt, validating and extending existing empirical research in the field.

V. CONCLUSION AND RECOMMENDATIONS

As evident from the results, adoption of digital forensic tools and data analytics, coupled with robust internal controls and fraud risk assessments, significantly enhanced the detection, prevention, and investigation of white-collar crimes in oil and gas firms in Port Harcourt. The findings demonstrated strong positive relationships between digital forensic practices and both detection/early warning and evidence gathering/chain-of-custody processes, while internal controls significantly reduced incidences of financial misconduct and improved investigative effectiveness. Additionally, corporate governance quality was found to moderate the relationship between forensic accounting practices and white-collar crime investigations, highlighting the critical role of governance in amplifying the impact of forensic interventions. These results confirm that a combination of technology-driven forensic tools, proactive internal controls, and strong governance structures are essential for mitigating white-collar crimes in the highly sensitive oil and gas sector.

Based on the findings, the following recommendations were made:

- 1) Invest in advanced digital forensic tools and data analytics platforms to enhance real-time detection and evidence management. Strengthen internal control systems and conduct regular fraud risk assessments to reduce the likelihood of financial misconduct
- 2) Implement comprehensive corporate governance practices, including active audit committees, transparent reporting, and whistleblowing mechanisms, to ensure forensic accounting findings are acted upon effectively; and
- 3) Provide continuous training for staff in both forensic accounting techniques and governance compliance to improve overall investigative capacity and organizational oversight.

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