MRS Journal of Accounting and Business Management
ISSN *(Online) 3049-1460*
Vol-3, Iss-2 (February-2026)
Journal homepage: https://mrspublisher.com/journals

FORENSIC ACCOUNTING RELEVANCE IN DETECTION AND PREVENTION OF PUBLIC SECTOR FRAUDS IN NIGERIA

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Received: 19 / 12 / 2025	Accepted: 25 / 01 / 2026	Published: 02 / 02 / 2026

Abstract: Fraud has remained a perennial problem that adversely affect economic growth in Nigeria. Nigeria has not fared well on the fraud and corruption index published by transparency international. Of concern is the upsurge in fraud cases especially in the public sector despite the setting up of regulatory agencies to tackle the anomaly. Globally, there is change in strategy for fraud investigations due to the inadequacies of traditional auditing methods towards the deployment of forensic accounting tools. Nigeria however has not been an exception. The efficacy of forensic accounting tools deployed in Nigeria in the fight against fraud is debatable. This study therefore has the goal to examine the effect of forensic accounting tools in detection and prevention of public sector frauds in Nigeria in the long run for the period 1999 to 2024 using primary and secondary data. The study used Hausman test for selection of model and multiple regression for determination of relationship. Various diagnostic tests were carried out to ensure reliability of results. The autoregressive distributed lag was used to determine short run and long run impacts of forensic accounting tools on public sector fraud. Findings revealed no significant effect of Investigative accounting, Data Mining and Litigation support in detecting public sector frauds in Nigeria. Although the short run effects were significant and negative, the long run effects were insignificant. However, Litigation support has no significant effect on both public sector Frauds in Nigeria signalling the ineffectiveness of the judiciary in giving relevant support to the agencies saddled with the responsibility to detect and prevent frauds. The long run effects of Forensic accounting on Frauds in Nigeria were found to be generally different from the short run effects. Based on failure of forensic accounting to produce impacts on public sector frauds the study recommends that Forensic accounting tools that focuses specifically on public sector frauds needs to be boosted in Nigeria. The study has demonstrated that forensic accounting tools do not deliver long run effects on fraud reduction. Since Public sector frauds affect sustainable developments in Nigeria regulatory agencies in Nigeria should be equipped with necessary forensic accounting tools to help in detection and prevention of frauds in Nigeria. There is also increased need for the public sector to strengthen internal controls and internal audit by exposing employees to necessary forensic accounting tools and employment of forensic accounting experts. Additionally, frauds is a direct reflection of societal values. Therefore, there is urgent need for re-orientation and the necessity for implementation of criminal laws to act as a deterrent to perpetrators.

Keywords: *Data Mining, Investigative Accounting, Litigation Support, Public sector Frauds.*

Cite this article: Ukeni, M. V. & Umobong, A. A. (2026). FORENSIC ACCOUNTING RELEVANCE IN DETECTION AND PREVENTION OF PUBLIC SECTOR FRAUDS IN NIGERIA. *MRS Journal of Accounting and Business Management, 3(2),1-14.*

Introduction

Fraud has remained one of the major vices ravaging and retarding Nigeria economic development. Nigeria's history of financial mismanagement and fraud dates back to pre-independence and early post-independence period, with several corruption scandals affecting national development. The second Republic (1979 – 1983) was marked by large scale financial mismanagement, while the military regimes of the 1980s and 1990s were characterized by systemic corruption. The democratic era (1999 – present) has also witnessed massive fraud cases, such as the Petroleum Subsidy Scam (2012) and the Arms procurement scandal (2015) and several other large-scale public-sector frauds

Despite numerous anti-corruption initiatives, fraudulent activities continue to undermine the country's economic stability and public trust. Large scale financial mismanagement, embezzlement, procurement fraud and misappropriation of fund has continued to occur in public sector. The increasing sophistication of fraudulent schemes has exposed the limitations of traditional auditing and regulatory mechanisms in effectively detecting and preventing fraud. Forensic accounting emerged as a vital tool in combating fraud through methods such as investigative accounting, litigation support, and data mining. Forensic accounting is a field that merges accounting, auditing and investigative techniques to detect, prevent and provide legal support in fraud related matters. The combination of investigative accounting, litigation support and data mining techniques into forensic accounting has improved fraud detection and management in Nigeria. However, despite the popularity of forensic accounting as an anti-fraud mechanism, its implementation in Nigeria remains inadequate, raising concerns about its effectiveness in addressing

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the country's perennial fraud problem. The reliance on internal audit, internal controls, and external auditing by auditor general's office has failed to curb complex fraud schemes, that occur in government agencies, Ministries and Parastatals. Fraudulent activities such as assets misappropriation, revenue leakages, and procurement fraud often go undetected until significant financial damage occurs.

Efforts by investigative agencies; Economic and financial crimes commission, independent corrupt practices and other related offences commission (ICPC), NFIU and the Central bank of Nigeria in the fight against fraudulent activities has not yielded intended results as frauds remains perennial in Nigeria Public sector. Nigeria has consistently ranked among countries with high corruption indices, as listed on Transparency International's Corruption Perception index (CPI). In Nigeria public sector, fraudulent practices such as budget padding, ghost workers' salaries, inflated contracts, and misallocation of public funds have continued to ravage the economy leading to significant financial losses and economic retardation. The problem of fraud is magnified by the untimely prosecution and delivering of judgement by the law courts. The problem is further exacerbated by insufficient financial evidence and complexity of financial crimes while there is dearth of skills in detecting such crimes.

Although there is global recognition of forensic accounting as a sophisticated tool for fraud prevention and detection, its application in Nigeria is limited. The literature on forensic accounting however highlights lack of awareness, inadequate expertise, weak regulatory frameworks, and limited technological infrastructure as hinderance to robust implementation of forensic accounting in Nigeria. Fraud is an anomaly and the dangers to the economy is enormous. Financial crimes contribute to revenue leakages, economic instability, unemployment, and poor public service delivery. Further, efforts and finite resources used in the fight against fraudulent activities can be invested in other areas of the economy.

Exacerbating the problem of fraud is the conflicting theoretical propositions and findings by prior research. There is no generally accepted fraud theory leading to myriads of theoretical propositions Whilst certain theoretical predictions focus on the symptoms of fraud, other theoretical paradigms focus on the social, psychological, techniques and motivations of fraud thereby creating a lacuna. Many empirical studies produced diverse results with no consensus. Many prior studies differ in methodology and mostly adopt survey methods and short-term remedies. This study deviates and assesses the efficacy of forensic accounting tools in detection and prevention of public sector frauds in Nigeria in the long run. The aim is to determine how forensic accounting tools used by investigative agencies help in detection and prevention of frauds in the public sector.

Literature

Variables Framework

Conceptual or operationalized framework can be depicted in form of drawing which shows the different categorization of the dependent and independent variable, mapping and inter-relationship (Creswell, 2003). This guide facilitates the delineation of the research scope, gap identifications and guides the study. Operationally for this study, the framework is depicted on figure 1

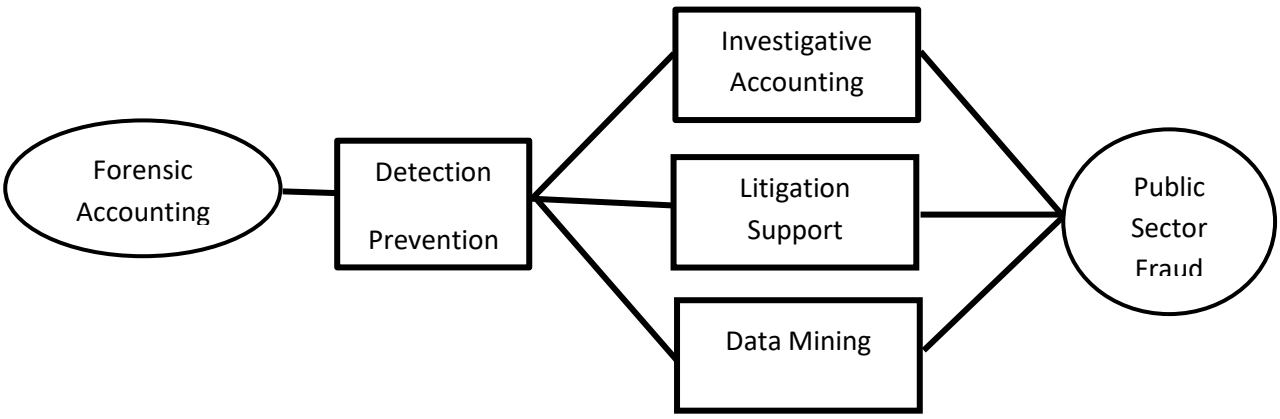


Fig 1: Operationalized Framework of Forensic Accounting and Public Sector Frauds in Nigeria

Investigative Accounting:

Investigative accounting is the backbone of forensic accounting, focusing on detection and analysis of fraudulent financial activities using auditing, accounting, and probing skills. The method requires scrutiny of financial records, interviewing relevant stakeholders, and deploying digital tools to discover illicit transactions and unethical conduct. Albrecht et al. (2012) explained investigative accounting as a combination of accounting skills and probing methods with objective of discovering financial anomaly. Investigative accounting is useful in Nigeria for detecting corporate fraud, revealing government misappropriation, tracing hidden assets, and determining financial statement integrity. Zysman (2004) explained data analytics, artificial intelligence, and digital forensics is valuable in tracking fraudulent activities. Investigative accounting ensures that fraud examination align with management governance standards and legal frameworks, contributing to a culture of accountability.

Litigation Support:

Litigation support imply assistance provided by forensic accountants in legal proceedings, particularly those involving financial disputes, fraud, and economic damages. This assistance involves analysis of financial records, preparation of expert reports, and provision of expert testimony in court. Bologna and Lindquist (2005) emphasized the importance of forensic expertise in resolving legal disputes involving complex financial issues.

Data Mining:

Data mining is a data-driven analytical tool that enables forensic accountants to detect anomalies, patterns, and suspicious

transactions in large financial datasets. It employs machine learning, artificial intelligence, and statistical techniques to uncover fraud that might not be visible through traditional audits. Fayyad, Piatetsky-Shapiro, and Smyth (2006) define data mining as the extraction of meaningful patterns from large datasets using computational tools. In Nigeria, where data integrity issues and fraudulent financial practices are prevalent, data mining enhances fraud detection capabilities in both public institutions and private organizations

Fraud

Fraud is the act of intentionally deceiving someone to gain an unfair or unlawful advantage, often for financial or personal gain. Fraud thrives and is perpetrated through misrepresentation and concealment of facts, abuse of trust to manipulate an individual, business or organization to enjoy. Financial statement fraud is a planned and intentional attempt by fraudsters whether corporate or individuals to deceive or mislead users of published financial statements, especially investors and creditors, by preparing and disseminating materially misstated financial statements' (Rezaee, 2005). Fraud extends beyond corporate malfeasances in financial statements to include larceny, embezzlement, diversion of funds, suppression, money laundering, deceit, asset misappropriation and many more fraudulent activities which enable the perpetrator to enjoy unmerited favor

Theoretical Framework

There are many theoretical propositions on the subject of fraud. However, this study is anchored on institutional theory, fraud pentagon and theory of reasoned action

Institutional Theory

Institutional theory examines institutions, norms, and regulations that shape behaviors and decision-making processes within organizations and societies. It explained that organizations make laws, rules, cultural norms, and that industry practices influence how organizations function and individuals' behaviors within the entity (Scott, 2008). Institutional theory is useful to forensic accounting and fraud detection by providing explanations why fraud, corruption and unethical behaviors persist in certain environments. In Nigeria, where corporate fraud, money laundering and improper financial disclosures are prevalent, the theory highlights how institutional weaknesses, regulatory inefficiencies and cultural factors contribute to fraudulent practices. However, institutional theory argues that organizations and individuals behave according to institutional pressures rather than just economic rationality. Scott (1995) identified three key components of institutions; regulative institutions (Rules, laws and regulations): This includes legal framework, enforcement agencies, and corporate governance structures that regulate financial and business activities. Strong regulatory institutions reduce fraud risks, while weak enforcement encourages fraudulent behaviors. In Nigeria, there is prevalence of weak enforcement of laws by regulatory bodies like the Economic and financial crimes commission (EFCC) and financial reporting council of Nigeria (FRCN) which allows fraud to thrive. The normative institutions on the other hand imply industry norms, ethical guidelines and professional standards that influence functionality of business entities for example; accounting and auditing standards, corporate governance principles, code of ethics for professionals. Forensic accountants rely on international and local standard, such as the International Financial Reporting Standards (IFRS) and Nigerian Financial Reporting Standards (NFRS), to detect financial misstatements and fraudulent disclosures. Cognitive Institutions (Cultural beliefs and social perceptions) include social norms, cultural attitudes, and public perceptions that shape behaviors in organizations and society. In Nigeria, a culture of impunity, patronage, and political interference often normalizes financial misconduct. For example, many Nigerian organizations view fraud as ''business as usual'', making forensic investigations and fraud detection more difficult. In summary, Institutional theory is highly relevant in forensic accounting and fraud detection because it explains how regulatory weaknesses, industry norms and cultural attitudes shape financial fraud risks. In Nigeria, where money laundering, corporate fraud and improper financial disclosures are widespread, the theory highlights why fraud persists despite regulatory reforms. Therefore, to combat fraud effectively, Nigeria must strengthen regulatory institutions (E.g. EFCC, FRCN), enforce corporate governance best practices and promote ethical business cultures and financial transparency. Forensic accountants and policy makers must work together to address institutional weaknesses, close regulatory loopholes and ensure accountability to reduce financial fraud and corruption.

The Theory of Reasoned Action

The Theory of Planned Behavior, which incorporates the Theory of Reasoned Action, was indeed developed by Ajzen and Fishbein in 1980. This theory is not specifically called "Fraud Preventive Theory" but rather explores how attitudes, subjective norms, and perceived behavioral control influence an individual's intentions and subsequent behavior, including potentially fraudulent actions. According to Ajzen and Fishbein (1980), Attitudes, subjective norms and perceived behavioral controls are the key elements that determine fraud. A person's positive or negative feelings toward a specific behavior, perceived social pressure to perform or not perform a behavior and an individual's belief about how easy or difficult it is to perform a behavior drives fraud These three factors, according to the theory, combine to shape an individual's intentions, which are the most immediate predictors of their behavior. This theory is particularly applicable in Nigeria public service and government where large scale fraud is daily occurring and the attitude of the individuals involved is that it is business as usual while government, the judiciary and the individuals continue to carry on as if nothing is happening

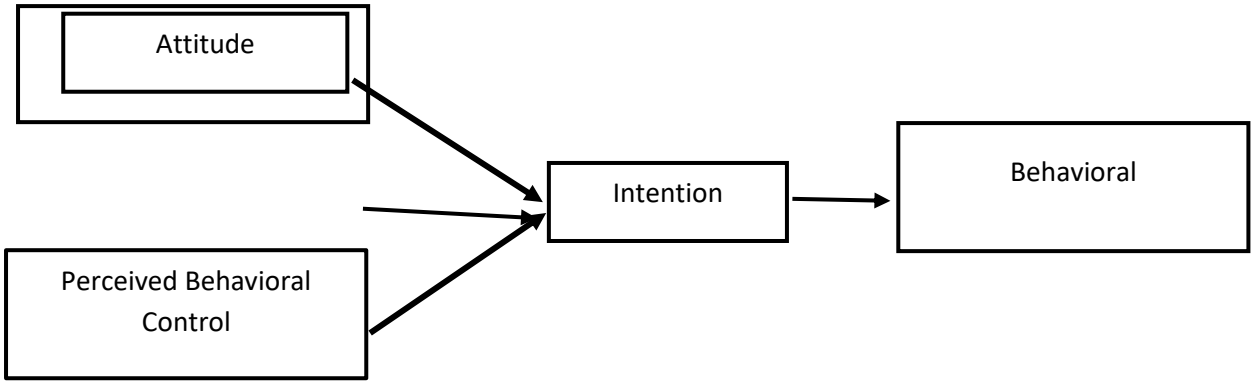


Fig: 2 Ajzen 1991, Theory of Planned Behaviour

Pentagon Theory

Fraud pentagon theory (Crowe Horwart, 2011) relies on the fraud diamond theory that identified competence and arrogance as drivers of fraud. The competence element has the same meaning as capability, which was previously identified in the fraud diamond theory as circumventing internal controls, developing a strategy to conceal fraudulent acts, and controlling the social situation for his or her benefit. Also, arrogance refers to the superiority attitude toward having special rights and the thought that an organization's internal control does not apply to them personally (Ewa, 2022). It contributes to the development of fraud management theory by trying to shed more light on the key factors that play a major role in whether fraud will actually occur and developing a model that will serve as a theoretical benchmark for all future reference. A close examination of the public fraud sociology in Nigeria reveals the arrogance displayed by politicians, ministers and directors of Ministries and agencies of government as if committing frauds and diversion of funds is not an anomaly. They constantly display "nothing will happen attitude" which is a sign of arrogance and feel above the law. Many of them plead guilty to fraud and rely on plea bargaining and negotiated settlements out of courts or refunds of certain percentages of loots which enabled them continue to enjoy benefits of the loot. Additionally, politics that goes with arrogance enabled the criminals to thrive by changing political parties to avoid prosecution

Empirical Review

Nuhu, Umar and Zannah (2025) investigated effect of forensic accounting skills on fraud detection in local governments of Yobe State using survey research design. Study confirmed forensic accounting skills do not affect fraud detection significantly at the local government level in Yobe State. Ojukwu et al (2025) conducted a study on forensic accounting and fraud detection in Nigeria universities. Results indicated Forensic accounting techniques significantly improved fraud detection and prevention capabilities in Nigerian universities. Investigative accounting and litigation support services were underutilized, mainly due to lack of trained personnel and institutional support. Study also revealed positive and significant relationship between the application of forensic accounting and the reduction of financial fraud in the university system. Anipiriworima, Tamunonimim and Tumba (2025) studied effect of forensic accounting skills on the fraud management of selected federal ministries, departments, and agencies in Nigeria. The results indicated accounting, auditing and forensic investigation skills have a positive and significant effect on the fraud management. Obadiah and Farouk (2024) studied effect of forensic accounting skills on financial fraud detection in state MDAs. The findings revealed that litigation and technical skills have significant positive effects on financial fraud detection of Ministries, Department and Agencies in Nigeria, while Investigative and auditing and analytical skills were found to have negative and significant effects on financial fraud detection of Ministries, Department and Agencies in Nigeria. However, ethical skill has insignificant but negative effect on financial fraud detection of Ministries, Department and Agencies in Nigeria.

Olowoseunre and Adewoye 2024) examined effect of forensic accounting mechanisms on fraud control in selected Nigerian federal government parastatals in southwestern Nigeria. Outcome of study indicated moderate positive correlation between effectiveness of forensic accounting mechanisms and ability to detect and prevent financial fraud in parastatals. Result showed statistical significance implying forensic accounting mechanisms improved detection and prevention of financial fraud. Okenwa and Chinecherem (2024) examined impact of forensic accounting on fraud detection and prevention in Nigeria and discovered that Fraud Detection & Prevention is significantly and positively influenced by Assisted Auditing Technique, Data Mining, Relative Size Factor and Benford Law.

Ogwiji (2023) examined the impact of forensic accountants' attributes knowledge, expertise, and litigation support services on financial crimes in Nigeria public sector. Findings confirmed expertise and support services provided by forensic accountants have significant positive effect on combating financial crimes, highlighting the necessity for specialized skills in fraud prevention and detection. Afor et.al (2023) examined forensic accounting techniques and fraudulent practices in Nigerian public sector. It was found that computer forensic techniques have significantly aided financial fraud evidence gathering. Also, forensic investigative techniques significantly aided financial fraud detection. Ozigbo and Arife (2023) investigated forensic accounting and corporate fraud prevention. The results of the study suggests that there is a significant difference in fraud prevention as a result of the use of forensic accounting in companies in Delta State. The study concludes that the use of forensic accounting by firms in Delta State has reduced cases of fraud. Olutayo et.al (2021) assessed the role of forensic accounting in reducing the level of fraudulent activities in Nigeria. The result revealed that forensic accounting proxy by Litigation Support Service and

Expert Witnessing had a negative significant effect on fraudulent activities in Nigeria.

Akani and Ogbeide (2018), examine forensic accounting and fraudulent practices in the Nigerian public sector. Findings indicate no significant relationship between forensic accounting and reduction of fraudulent practices in the Nigerian public sector. Dauda, Ombugadu and Aku (2016) an investigation was carried out on forensic billing techniques and fraud detection and prevention in the public sector, Nasarawa State. The impact on forensic accounting methods in both detection and prevention of fraud in the public sector in Nasarawa State is highly significant in Nigeria. Modugu and Anyaduba (2013) examined Forensic accounting and financial fraud in Nigeria findings from the study are forensic accounting significantly reduces financial fraud by improving fraud detection and prevention and organizations that apply forensic auditing techniques report fewer fraud cases compared to those that rely solely on traditional auditing methods.

Methodology

Research Design

The study adopts longitudinal and ex-post facto design because the researcher was after the fact, and due to the nature of the data to be analyzed. The design for the study is based on partly primary data obtained from Questionnaires and secondary data obtained from central bank, federal and office statistics bulletin, EFCC and ICPC. The sample consisted of 25 years (1999-2024) observations which was considered a good representative of the population and adequate for reliable empirical results based on data availability. Using a purposive sampling method based on data availability and ease of obtaining information from EFCC and ICPC and the availability of information at Federal office of statistics website.

Variables of the Study

The independent variable used in the study is Forensic accounting. When there is use of investigative accounting, Litigation support and data mining the value 1 is assigned and when it is not in use the value 0 is assigned. The dependent variables for this study is fraud that occur in the public sector annually for a period of twenty-five years. The length of time any forensic tool is used and the years is also be provided by EFCC and ICPC to facilitate a panel data framework that will enable the researcher answer the relevant research questions. For forensic accounting the study examined it from two perspective detection and prevention with each tool being examined in this context. Thus, we have six proxies with each tool having the feature of detection and prevention. Litigation support, Data Mining and Investigative accounting.

Measurement of Variables summarized on Table 1 below:

Independent Variable	Measurement	Expected Sign
Investigative Accounting Detection (IVAD)	Assigned value of 1 when used as a detective tool otherwise 0	Negative
Litigation Support Detection (LITD)	Assigned value of 1 when used as a detective tool otherwise 0	Negative
Data Mining Detection (DATD)	Assigned value of 1 when used as a detective tool otherwise 0	Negative
Investigative Accounting – Prevention (IVAP)	Assigned value of 1 when considered as effective in fraud prevention with 60% Yes otherwise 0	Negative
Litigation support- - Prevention (LITP)	Assigned value of 1 when considered as effective in fraud prevention with 60% Yes otherwise 0	Negative
Data Mining – Prevention (DATP)	Assigned value of 1 when considered as effective in fraud prevention with 60% Yes otherwise 0	Negative
Dependent Variable		
Public sector fraud)	Natural log of Annual figures of fraud that occurred in the private sector as published by FOS , CBN , EFCC and ICPC	Negative

Model specification

$PUBF = =\beta_0 + \beta_1 IVAD + +\beta_2 DATD + \beta_3 LITD + \beta_4 IVAD + +\beta_5 DATP + \beta_6 LITP + U2, t$……. (i)

. In line with Pesaran et al. (2001), the unrestricted error correction mechanism for testing co-integration among the variables used in this study is stated as follows:

$\Delta PUBSF_t = \beta_0 + \sum\beta_1 \Delta Log DATD_{t-1}\, \beta_0 + \sum\beta_1 \Delta Log LITD_{t-1} + \sum\beta_2 \Delta Log IVAD_{t-1} + \sum\beta_3 \Delta Log IVAP_{t-1}\ \sum\beta_4 \Delta Log LITD_{t-1}$

$+\sum\beta_2 \Delta Log DATP_{t-1} + \ \alpha_0 + \alpha_1 \Delta Log\ DATD_{t-1} + \alpha_2 \Delta Log\ LITD_{t-1} + \alpha_3 \Delta Log\ IVAD_{t-1} + \ \alpha_4 \Delta Log IVAP_{t-1} + \alpha_5 \Delta Log\ LITP_{t-1} + \alpha_6 \Delta Log\ IVAD_{t-1}\ U_2, t$……..(ii)

The ARDL long-run model is estimated if cointegration is found while the short-run model is estimated if otherwise

$$\Delta PUBSF = \ldots\ \beta_0 + \beta_1 \mathit{Log}DATD_{t-1} + \beta_2 \mathit{Log}LITD_{t-1} + \beta_2 \mathit{Log}IVAD_{t-1}\ \beta_3 \mathit{Log}IVAP_{t-1} + \beta_2 \mathit{Log}LITP_{t-1} + \beta_2 \mathit{Log}DATP_t + U_2,\ t \ldots \text{(iii)}$$

$$\Delta PUBSF = \alpha_0 + \alpha_1 \sum \Delta \mathit{Log}\ DATP_{t-1} + \alpha_2 \sum \Delta \mathit{Log}\ LITD_{t-1} + \alpha_3 \sum \Delta \mathit{Log}\ IVAD_{t-1} + \alpha_4 \sum \Delta \mathit{Log} IVAP_{t-1} + + \alpha_1 \sum \Delta \mathit{Log}\ LITD_{t-1} + \alpha_2 \sum \Delta \mathit{Log}\ DATP_{t-1} + ECM + U_4 \ldots\ldots \text{(iv)}$$

Diagnostic tests

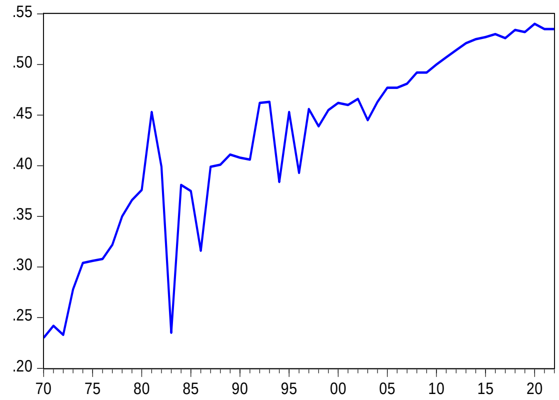
ARDL assumptions require, no serial correlation. That is, no autocorrelation must exist with the error terms, data should not have heteroscedasticity. This implies that the variances and means must be constant over time, and the data in question must follow normal distribution. Finally, cumulative sum (CUSUM) test will also be employed to know the fitness of the model. The study conducts four diagnostic tests using normality test, serial correlation LM test, heteroscedasticity test, and cumulative sum (CUSUM) test to fulfill all these conditions.

Results

Trend Analysis

In Figure 3, the trend in public sector fraud for Nigeria is presented. There is a clear pattern of upward movement over the period, from as low as 0.25 in 1999 to over 0.5 in 2022. Thus, there is evidence that public sector frauds have increased significantly over the period, the current public sector fraud score of more than 0.55 indicates that Nigeria can still be considered as being a highly fraudulent country.

Fig. 3: Trends in PBSF



Summary Statistics

The average public sector fraud for the period is .43, which is high and shows that overall public sector fraud has been high above the median global level. Both the standard deviation (0.09) and the skewness (-0.67) scores show that the public sector frauds in Nigeria have varied widely from the mean value over the years.

Table 2: Descriptive Statistics for Panel Data

Variable	Mean	Max.	Min.	Std. Dev.	Skew.	Kurt.	J-B	Prob
PUBSF	0.43	0.54	0.23	0.09	-0.67	2.57	4.32	0.12
IVAD	23.77	176.36	-82.24	42.59	1.13	5.79	27.89	0.00
DATD	27.39	166.67	-78.57	52.07	0.91	4.01	9.34	0.01
LITD	37.18	860.00	-87.80	123.74	5.81	39.17	3126.02	0.00
IVAP	120.59	5136.53	-99.88	709.62	6.99	49.91	5190.70	0.00
DATP	2.67	3.11	2.28	0.18	0.60	3.32	3.37	0.19
LITP	29.63	55.02	7.52	10.38	-0.19	2.72	0.50	0.78

The average growth rates of use of Forensic accounting tools variables are reported in the Table. Average growth rate of litigation support stood at 37.18 percent per annum is highest among the tools employed. Thus, it is seen that the use of litigation support increased at a significant rate than the use of investigative accounting over the years. There were periods of significant use of forensic accounting tools especially litigation support as shown by a maximum growth rate of 860 percentage points). Average effectiveness of data mining is 2.67 per annum over the study period. While that of litigation support is 29.63 indicating litigation support is more effective than data mining. However average effectiveness for investigative accounting stood at 129.59.

Correlation

Forensic investigation is generally incremental in nature and responds to changes in fraud trends which significantly increases over time and tends to move both in data mining and Litigation support. This implies that variables used in a single estimation may exhibit the problem of multicollinearity.

Table 3: Correlation Matrix

Correlation Probability	PUBSF	IVAD	DATD	LITD	IVAP	DATEP	LITP
PUBSF	1.0000						

IVAD	0.5911	1.000					
	0.00	-----					
DATD	0.5614	0.985	1.000				

	0.00	0.00	-----				
LITD	0.5974	0.998	0.974	1.000			
	0.00	0.00	0.00	-----			
IVAP	0.5970	0.939	0.899	0.947	1.000		
	0.00	0.00	0.00	0.00	-----		
DATP	0.8878	0.804	0.765	0.812	0.808	1.000	
	0.00	0.00	0.00	0.00	0.00	-----	
LITP	0.1267	-0.125	-0.081	-0.143	-0.177	0.037	1.000
	0.36	0.31	0.50	0.30	0.20	0.79	-----

Among the Forensic accounting variables, there is a strong positive correlation among the three variables. Indeed, the correlation coefficient between IVAD and LITD is 0.998, while it is 0.985 with DATD. Also, DATD is correlated with LITD with a coefficient of 0.974. This shows that the correlations among the forensic variables are too large for these variables to be included in a single equation. In order to minimise the problem of multicollinearity in the estimates, the three variables are estimated in a recursive way.

4.2.1. Test for Normality of Data

The normality (based on the Kernel tests) for the variables are reported in Figure 4.8. The kernel density plots for each of the variables in the chart indicate that none of the variables is normally distributed since the kernel plots are all concentrated away from the centre of the plot and there are also mostly widely spread.

Fig. 4.a: Kernel Density Test for PUBSF

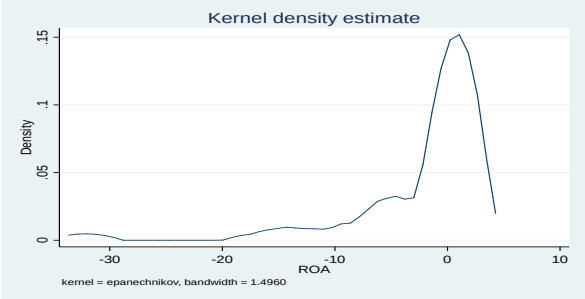


Fig. 4.b: Kernel Density Test for LITD

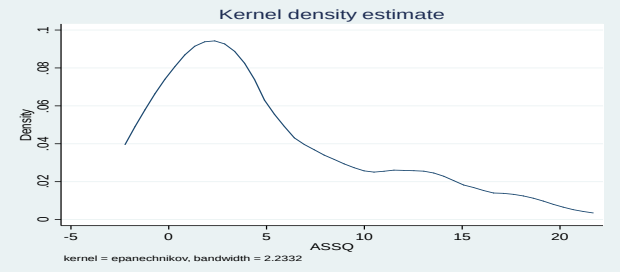


Fig. 4.c: Kernel Density Test for IVAD

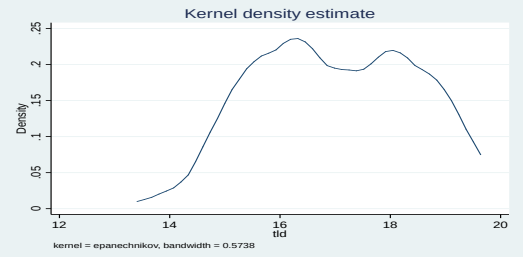
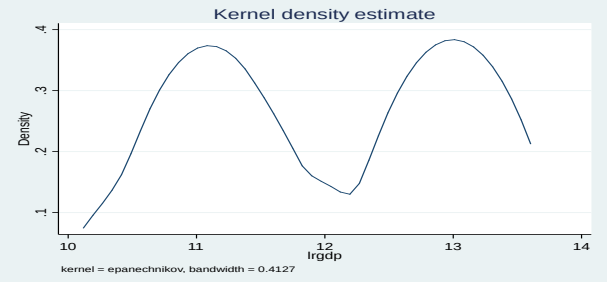


Fig. 4.d: Kernel Density Test for DATD



4.3. Unit Root and Cointegration Analysis

The test for stationarity of the data series is performed using two different methods namely, the Augmented Dickey Fuller (ADF) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) procedure. The results of the unit root tests are presented in Table 4

Table 4: Unit Root test for Variables

Variable	ADF Test		KPSS		Order of Integration
	Levels	*First Difference*	*Levels*	*First Difference*	
PUBSF	-2.172	-9.697**	0.961**	0.110	I(1)
IVAP	-1.012	-7.003**	0.512**	0.140	I(1)
IVAD	-3.263*	-3.454*	0.586*	0.205	I(0)
DATD	-0.358	-8.727**	0.968*	0.193	I(1)
LITD	0.804	-5.373**	0.841**	0.273	I(1)
DATP	-3.273*	-3.171*	0.144	0.991**	I(0)
LITP	-2.938*	-3.085*	0.252	0.498*	I(0)

*Note: * indicates signifies at 5 percent; 95% critical values are reported in parentheses below each test value*

From the results of the ADF tests reported in the first panel of Table 4, it can be seen that the ADF test statistics for each of the variables in levels (IVAD) are less than the 95 percent critical values indicating that they are insignificant. On the other hand, the test statistic values for the series in first differences are greater than the critical values at the 5 percent significance level Thus, those variables are non-stationary in levels but their first differences were found to be stationary. This implies that most of the variables in the study are integrated of order one (or I[1]). On the other hand, IVAD, DATP and LITP is integrated of order zero (or I[0]). The KPSS test for stationarity tends to improve on the robustness of the unit root tests.: a significant KPSS coefficient for a variable indicates non-stationarity. The result indicates that for each of the series, the null hypotheses of stationarity cannot be rejected for the variables in first differences (the tests statistics fail the test This indicates that the series are difference-stationary and that most of the variables are actually I[1]. This implies that a dynamic long run relationship may be estimated based on the ARDL approach to cointegration for the dynamic analysis. Essentially, it is appropriate to use cointegration analysis to estimate the relationships between the variables.

The tests of stationarity provide grounds for examining the long run properties of the dataset in terms of cointegration analysis. From the unit root tests, it is seen that most of the variables are I(1) while three are I (0). Thus, there is the need to establish the cointegration status of the data in order to determine the long run equilibrium relationship among the variables. the test for common stochastic trends or cointegration is performed using Bounds cointegration test procedure in order to further determine the long run time series properties. The evaluation of the Bounds cointegration results shown in Table 5 is based on the critical F-statistic values for the lower and upper bounds as also reported in the results. This test is interpreted based on the following procedure: if at any significance level, the estimated F-value is greater than both the lower test (I0 Bounds) and the upper test (I1 Bounds) values, then there is no cointegration among the variables. If the estimated F-value lies between the two Bounds values, then there is need to proceed with a lesser structure of the ARDL analysis. However, if the estimated value lies above both Bounds test values, then there is clear cointegration among the variables.

Table 5: Bounds Cointegration Test

Test Statistic	Value	Signif.	I(0)	I(1)
Eqn: PUBSF				
F-statistic	6.42	10%	2.37	3.2
K	3	5%	2.79	3.67

The results in Table 4.4 indicate that the computed F-values for the Bounds test for each of the equations of 8.41 are all larger than both the I(0) and I(1) Bounds tests at the 5 percent. The F-values therefore pass the significance test at the 5 percent level for all the fraud estimated equations. Thus, a long run relationship is established between frauds in both the frauds variables and other variables in the model. This provides a strong background for the analysis of the ARDL model in the study.

Regression Analysis

The process of ARDL analysis involves first examining the lag selection procedure in order to determine the optimal lag length

that expresses the relationship.

Lag Length Selection

In the lag selection, optimality of the model was determined using both the Akaike Information Criterion (AIC) and Schwarz–Bayesian Criterion (SC). The results are presented in Table 6.

Table 6: Lag Length Selection Criteria

No of Lags	**PUBSF**	
	AIC	*SC*
0	3.62	3.9
1	-2.5	-0.78
2	-1.36	-1.74
3	-2.46	-1.44
4	-4.62*	-3.09*
5	-1.82	-1.33

Note: * indicates selected lag.

The optimum lag length is determined by considering the least values for both of the test coefficients. The results shown in Table 4.5indicate that, for each of the equations (using the two frauds variables), the fourth lag possesses the minimum value. However, given that the AIC test for the equation as well as all the other equations select the fourth lag, four lags are selected as optimal for all the equations. This implies the first four lags are expected to be retained for the VECM estimation.

Analysis of ARDL Results

Forensic Accounting and Public Sector Frauds in Nigeria

The results for the effects of forensic accounting on public sector frauds are presented in Table 7. The goodness of fit indicators in the model are impressive. The adjusted R-squared value for the equation with Investigative accounting is 0.897, while the value for the equation with Data mining is 0.892 and the value for the Litigation support equation is 0.93. These outcomes indicate that at least, 89 percent of the variations on public sector fraud was explained by the models specified in the study. Although the ARDL estimation already takes care of the first order serial correlated issues, the results of the D.W. tests are also reported. In all the estimates, the D.W. statistics had values that are sufficiently close to 2.0. This shows absence of first order serial correlation.

Table 7: Results for Forensic Accounting and Public Sector Fraud

Variable	*Investigative Accounting*			*Data Mining*			**Litigation Support**		
	Coeff.	**t-Stat.**	**Prob.**	**Coeff.**	**t-Stat.**	**Prob.**	**Coeff.**	**t-Stat.**	**Prob.**
Short run									
$\Delta IVAD_t$	0.022	1.84	0.08						
$\Delta DATD_t$				-0.020	-8.012	0.00			
$\Delta LITD_t$							0.04	4.74	0.00
$\Delta LITD_{t-1}$							0.04	3.19	0.00
$\Delta LITD_{t-2}$							0.05	4.64	0.00
$\Delta LITD_{t-3}$							0.03	2.55	0.02
$\Delta LIVAP$	-0.024	-8.90	0.00	0.000	0.119	0.91	0.00	0.39	0.70
$\Delta LIVAP_{t-1}$	0.001	0.60	0.55	0.019	6.201	0.00	0.00	-0.57	0.57
$\Delta LIVAP_{t-2}$	0.018	6.17	0.00				0.02	7.55	0.00
$\Delta LIVAP_{t-3}$							0.01	1.92	0.07
$\Delta LITP$	0.001	3.71	0.00	0.002	4.988	0.00	0.00	2.14	0.04
$\Delta LITP_{t-1}$	-0.001	-2.87	0.01	-0.001	-3.141	0.00	0.00	-2.23	0.04
$\Delta DATP$	0.100	2.34	0.03	0.095	2.191	0.04	0.02	0.37	0.71
$\Delta DATP_{t-1}$	-0.227	-3.76	0.00	-0.212	-3.412	0.00	-0.13	-1.84	0.08
$\Delta DATP_{t-2}$	0.204	5.70	0.00	0.163	4.213	0.00	0.11	1.63	0.12
$\Delta DATP_{t-3}$							0.11	2.15	0.04
ECM_{t-1}	-0.813	-8.51	0.00	-0.834	-8.244	0.00	-1.19	-6.72	0.00
Long run									
IVAD	-0.004	-0.21	0.84						

DATD				-0.013	-0.867	0.39	-0.02	-1.23	0.23
LITD									
LIVAP	-0.017	-0.75	0.46	-0.013	-0.644	0.52	0.01	0.66	0.52
LITP	0.002	2.27	0.03	0.003	2.838	0.01	0.00	2.83	0.01
DATP	0.000	0.23	0.82	0.001	1.024	0.31	0.00	-0.62	0.54
C	0.187	3.99	0.00	0.182	3.858	0.00	0.18	4.51	0.00
Adj. R-sq.	0.897			0.892			0.93		
D-W stat	2.008			1.971			1.95		

The upper panel of the Table shows the estimates for short run behaviour of public sector frauds in terms of fraud effects. The result shows that investigative accounting has a positive short run effect on public sector frauds in Nigeria, although the coefficient is not significant at the 5 percent level. The coefficient of data mining however passes the test at the 1 percent level and is negative. This shows that increase in data mining for investigation purposes has negative effect on public sector frauds in the short run. This result may be as a result of the fact that data obtained from data mining are long-term in terms of their usefulness in further investigations. The coefficient of litigation support is significant for both the current and lagged effects. This result shows that litigation support has significant positive effect public sector frauds in the short run in Nigeria. The short run effects are shown to be both immediate and delayed. Thus, the result shows that only litigation support have positive immediate effects on public sector frauds in Nigeria in the short run. The coefficient of effectiveness of investigative accounting is mostly positive and significant in the short run results. The coefficient of effectiveness of data mining is positive for current variable and negative in the lagged effect. While effectiveness of litigation support is also shown to have positive short run effect on PUBSF.

The coefficient of the error correction terms for each of the equations is significant at the 1 percent level and has the expected negative sign. This shows that any short-term deviation of public sector frauds from its long run equilibrium path will be restored in the long run. The coefficient of the error correction terms for the equations with DATD and IVAD are similar with values around -0.8 which shows that adjustment to long run equilibrium for public sector frauds is quite rapid in Nigeria. This is because up to 80 percent of long run adjustment is completed in the first period. For the equation with LITD, the coefficient of the error correction term is greater than one in absolute value. This indicates that adjustment to equilibrium is not asymptotic, rather Litigation support enforces an unstable adjustment.The stable impacts of Forensic accounting on public sector frauds are examined by focusing on the long run estimates for each of the equations. The results are shown in the lower panel of the results in Table 7. In the result, the coefficients of all the three forensic accounting tools fail the significance test at the 5 percent level. This shows that Forensic accounting does not have significant long run effects on public sector frauds in Nigeria. Although the short run effects were observable and significant in the cases of Data mining and Litigation support there is evidence that the long run effects are insignificant. Thus, the result reveals that after all necessary adjustments have been made, an increase in forensic auditing does not significantly influence public sector frauds in Nigeria.

Post Estimation Tests

Multicollinearity Tests

In Table 8, the results of the multicollinearity test for the each of the models results (containing the six variables separately) are presented. In the result, only the centred variance inflation factors (CVIF) variables are reported since each of the equations contains a constant term. The VIF value must be less than 5.0 for the variable in an equation to be free from collinearity. In the report on Table 8, the Centred VIF values for all the variables are less than 5.0. Thus, it can be seen that the estimated coefficients for the equations do not integrate excessively among themselves and the estimates are therefore reliable.

Table 8: Post Estimation Test Results

Variable	IVAD	DATD	LITD
IVAD	2.233		
DATD		3.044	
LITD			1.560
IVAP	3.253	3.791	2.933
LITP	2.662	3.102	2.400
DATP	3.457	4.029	3.117

Tests for Stability of Regression

The initial form of tests for stability is conducted by observing the residuals from the estimates in terms of their serial correlation and normality. The normality test is also conducted using the J-B procedure since this test also helps to determine stability of estimates. Note that the serial correlation tests are performed using the LM statistics. From the results, none of the J-B and LM

statistics passed the significance test even at the 5 percent level which implies that the null hypothesis is accepted in both cases. The null hypothesis is the absence of non-normality and serial correlation respectively. Thus, the tests indicate that the residuals are normally distributed and are devoid of serial correlation. Thus, each of the estimated equations can be adjudged to be stable and effective for long term prediction and analysis.

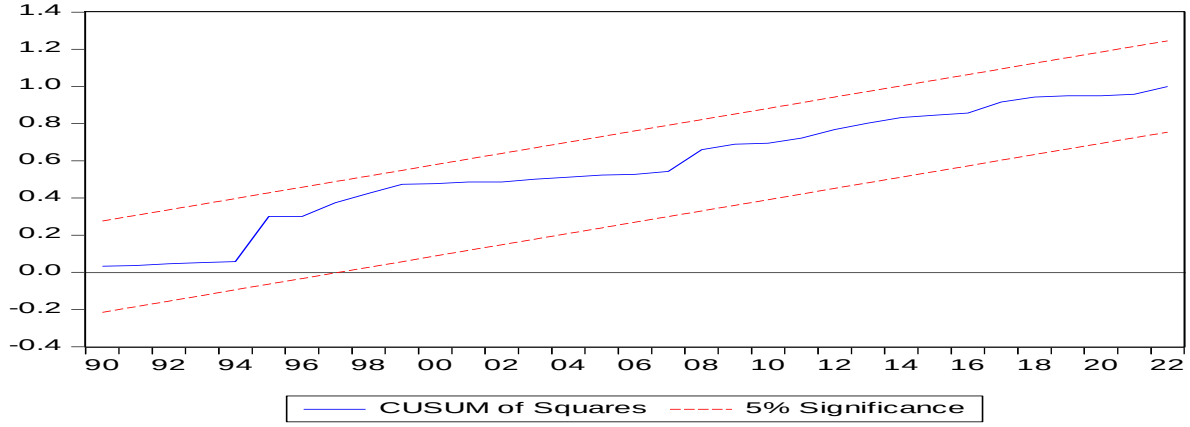
Table 9: Post estimation test results for serial correlation and normality

Model	***Test***	*Stat. (prob)*
PUBSF	*Normality test (J-B)*	1.23 (0.31)
	Serial Correlation LM Test	1.25 (0.64)

Note: p-values in parentheses.

A visual test of the stability of the estimates is also conducted using the CUSUM of squares tests. The charts in Figure 5 show the result of the CUSUM of squares test for recursiveness of error accumulation. the CUSUM of squares line lies entirely within the dotted 5 percent significance bound line throughout the chart for each of the charts. This reveals that the estimations are all stable within the analysis and there are no issues of structural breaks or outlier effects in the estimations.

Fig. 5: CUSUM for PUBSF



Tests of Hypotheses

H01: There is no significant effect of Investigative Accounting in detection and prevention of public sector Frauds in Nigeria

For the test of this hypothesis, the focus is on the coefficients of Investigative accounting in the long run estimates for detection and prevention of frauds in the public sector. From the results on Table 4.6 in detection of frauds denoted by IVAD, the coefficient of IVAD is negative -0.004 (p =0.084>0.05). From the result, p-value is greater than 0.05 indicating it fails the significance test at the 5 percent level. This shows that the null hypothesis cannot be rejected in this case. Thus, the result reveal that there is no significant effect of investigative accounting on detection of public sector frauds in Nigeria. There is a weak relationship increase in investigative accounting reduces public sector frauds insignificantly.

In the case of Prevention of fraud (IVAP) using Investigative accounting tools based on table 4.6, there is a negative co-efficient of -0.017 and p-value 0.46>0.05 indicating insignificance of the contribution of Investigative accounting in prevention of public sector frauds in Nigeria. The hypothesis that there is no significant effect of Investigative accounting in prevention of frauds in Nigeria is accepted

Hypothesis 2: There is no significant effect of Data Mining in Detection and Prevention of Public Sector Frauds in Nigeria

For the test of hypothesis two, the focus is on data mining and public sector frauds.

Detection of fraud using Data mining frauds is examined in this paragraph. The From the result, on Table 4.6, the coefficient of DATD is negative --0.013 (p =0-39>0.05). From the result, p-value is greater than 0.05 indicating it fails the significance test at the 5 percent level. This shows that the null hypothesis cannot be rejected in this case. Thus, the result reveal that there is no significant effect of Data mining on detection of public sector frauds in Nigeria. There is a weak insignificant relationship of Data mining by regulatory activities in detecting public sector frauds in Nigeria.

This paragraph focuses on data mining (DATP) as a forensic accounting tool in preventing public sector frauds in Nigeria. From table 4.6, there is a positive co-efficient of 0.001 and p-values 0.31>0.05. From the outcome, the result is insignificant showing insignificant relationship between data mining tools used by regulatory authorities and prevention of public sector frauds in Nigeria. Based on outcome, we accept the hypothesis that there is no significant relationship between data mining and prevention of public sector frauds in Nigeria.

H03: There is no significant effect of Litigation support in detection and Prevention of public sector Frauds in Nigeria

For the test of this hypothesis based on table 4,6, first Litigation support as a tool for detection of public sector is examined. LITD has a negative co-efficient -0.02 (p=0.23 > 0.05). For the variable, the coefficient fails the significance test at the 5 percent level. This shows that the null hypothesis cannot be

rejected in this case. Therefore, the hypothesis which states that there is no significant effect of Litigation support on detection of public sector fraud is accepted. Thus, the result reveal that there is no significant effect of Litigation support on detection of public sector frauds in Nigeria.

In this paragraph, Litigation support (LITP) as a tool for preventing public sector fraud is examined. From the result on table, a positive coefficient of 0.00 and p-values of 0.01<0.05. From the result there is a significant relationship, between Litigation support and public sector frauds in Nigeria. Increase in Litigation support increases public sector frauds in Nigeria indicating the inefficacy and failure of the judiciary in helping the fight against frauds in Nigeria. Based on the p-values we reject the hypothesis that Litigation has no significant effect on public sector frauds in Nigeria

Conclusion

Forensic accounting tools is deployed by regulatory agencies in the fight against fraud and corruption in Nigeria both in the public and private sector. The efficacy of this fight in curtailing fraud and corruption is debatable. However, in this study the impact of Forensic accounting tools in detecting and preventing both private and public sector frauds in Nigeria is examined. The aspects emphasized the role of forensic accounting in mitigating the incidence and number of frauds in Nigeria. Thus, the study considered the distributional outcomes of Forensic accounting in fraud management in Nigeria.. In this regard, number of incidence and figures were obtained from regulatory agencies through questionnaires and content analysis. Forensic accounting tools were classified into Investigative accounting, Data Mining and Litigation support while questionnaires were administered to obtain relevant information before coding and conversion to quantitative. In particular, the following conclusions were made:

a) There is no significant effect of investigative accounting on detection of public sector frauds in Nigeria. There is a weak relationship, increase in investigative accounting reduces public sector frauds insignificantly.
b) Insignificance contribution of Investigative accounting in prevention of public sector frauds in Nigeria.
c) There is no significant effect of Data mining on detection of public sector frauds in Nigeria. There is a weak insignificant relationship of Data mining by regulatory activities in detecting public sector frauds in Nigeria.
d) Insignificant relationship between data mining tools used by regulatory authorities and prevention of public sector frauds in Nigeria.
e) There is no significant effect of Litigation support on detection of public sector frauds in Nigeria.
f) Increase in Litigation support increases public sector frauds in Nigeria indicating the inefficacy and failure of the judiciary in helping the fight against frauds in Nigeria.

Recommendations

The following recommendations are made based on the findings from the study:

i) Forensic accounting tools that focus specifically on public sector frauds needs to be boosted in Nigeria. The study has demonstrated that forensic accounting tools do not deliver long run effects on fraud reduction. Since Public sector frauds affect sustainable developments in Nigeria regulatory agencies in Nigeria should be equipped with necessary forensic accounting tools to help in detection and prevention of frauds in Nigeria both in the private and public sector
There is the need for all stakeholders to contribute to the drive for mitigation of frauds in Nigeria. The study has shown deficiencies and advantages in the tools presently being employed in the fight against frauds in Nigeria. It is therefore essential that regulatory agencies should leverage on more advanced forensic accounting tools to improve their performance in mitigating frauds.
ii) Training of staff and increased technological application for effective fight against corruption
iii) Increased need for governmental agencies and politicians to avoid undue influence and pressure on high profile corruption and fraud cases.
iv) Improved independence of the judiciary and enhanced integrity and application of law

Suggestions for Further Study

This study focused on Forensic accounting as tools for detection and prevention of frauds in Nigeria using autoregressive distributive lag. Fraud was proxied using public fraud from figures obtained from regulatory agencies while forensic accounting tools used content analysis of tools used for investigation; Investigative accounting, Data mining and Litigations support obtained through questionnaires. Other studies can use different methodologies to study the effect of Forensic accounting on frauds in Nigeria. Also, other studies can use different Forensic accounting tools to study the effect of Forensic accounting on Frauds in Nigeria. This study did not adopt any moderating or control variable in examining forensic accounting nexus. This issue can be taken into consideration by other studies.

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