DATA MINING INCORPORATION FRAMEWORK FOR COMBATING ELECTRONIC FRAUDS IN NIGERIA

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Abstract
Fraud has become headache the world over. In this paper we propound Data Mining Incorporation Framework (DMIF) that can assist governments through their anti-graft agencies, in combating the heinous fraudulent practices, particularly in financial institutions. To do this end, we review a number of financial fraud cases (FFCs) in Nigeria as a particular case where financial fraud has become a serious problem in the business of government. Some of the different data mining techniques which are applicable to this problem are reviewed. The structure of these techniques as it can be applied to assist government to reduce this menace is designed. The analysis of fraud cases clearly shows that frauds are prevalent in Nigeria and the design will no doubt help in the fight against the menace.

Keywords: Anti-graft agency, Framework, Fraud schemes, Data mining, Incorporation

Introduction

The world over, frauds, particularly the financial aspects, have become "more than a persistent headache", that would not allow anyone to rest. Various bodies: security outfits, regulatory agencies, anti-fraud bodies, governments and so on, have reported cases of high profiles of financial fraud cases. These frauds are perpetrated by means of falsifying techniques that appear to be true in the face of the victims. Fraud is a global phenomenon that has been in existence long before now, and has continued to increase geometrically. Nwankwo (2013) has defined fraud as a deliberate act that causes a business or economy to suffer damage, often in the form of monetary losses. Fraud has also been defined as a deliberate act by one or more individuals among management, employees or third parties which results in a misrepresentation of financial statement (Nwankwo, 2013; Adeniji, 2004). Financial fraud is posing a progressively more threat to economy globally. A striking case in Ponzi scheme, perpetuated by the former NASDAQ chairman, Bernard Madoff, led to the loss of about US$50 billion worldwide (FBI, 2008). Another outstanding case is that of Joseph Hirko, former co-chief executive officer of Enron Broadband Services (EBS), who after pleading guilty to wire fraud, avowed to forfeit approximately US$8.7 million in restitution to Enron victims through the U.S. Securities and Exchange Commission's Enron Fair Fund (FBI, 2008). In 2007 BBC news report (BBC, 2007), fraudulent insurance claims cost UK insurers a total of 1.6 billion pounds a year.

Apparao et al. (2009), state that financial statement frauds (FSF) have received considerable attention from the public, the financial community and regulatory bodies because of several high profile frauds reported at large corporations such as Enron, Lucent, and WorldCom and Satam computers over the last few years. Fabricating financial statements primarily consists of elements manipulation by overstating assets, profit, or understating liabilities. The use of normal audit procedures to detect management fraud is quite a difficult task (Coglitore & Berryman, 1998). Fanning and Cogger (1998) argued that detecting management fraud is difficult because: firstly, there is a shortage of knowledge concerning the characteristics of management frauds; secondly, most auditors lack the experience necessary to detect such

frauds; finally, financial managers and accountants are deliberately trying to deceive the auditors. For such managers, with limited knowledge of an audit system, standard auditing procedures may be insufficient. These limitations suggest the need for additional analytical procedures for the effective detection of false financial statements (Apparao et al., 2009).
The perpetration of fraud is particularly rude in Nigeria that many took place undetected and the few ones detected went unpunished, practically because in most cases for lack of enough evidence against the suspects. More so, some affected individuals or managements are usually reluctant to release adequate information on fraud as it affects them (Owolabi, 2010). In the eighties, organized crime elements with ties to Nigeria have come to dominate crime emanating from West Africa. These criminal groups, also known as Nigerian Crime Enterprises (NCE's), have become adept at executing transnational criminal activities, including fraud schemes directed against the United States (Jim & Alex, 2001). The choice of Nigeria is borne out of incessant cases of financial fraudulent activities against various financial sectors, particularly the banking sector. Experts claimed that most of these sham activities are taking place unreported. The fear now is that the increase rate of fraud in the financial institutions, if not arrested might pose certain threats to the stability and the survival of individuals, financial institutions and the performance of the industries as a whole and no area of the economy would be immune from fraudsters (Nwankwo, 2005).

Detecting frauds is not an easy task as the criminals themselves are knowledgeable and smart using such tools as Internet facilities. This situation not only requires adequate information and knowledge, but also an improved designed structure, (such as DMIF proposed here) if a riposte against this menace is to be made. Data mining and statistical methods have been proved to successfully detect fraudulent activities such as money laundering, e-commerce credit card fraud, telecommunications fraud, insurance fraud, and computer intrusion (Apparao, 2009).

According to "Oxford Dictionary" (2010), a government is the system by which a state or community is governed. Government of any kind affects every human activity in many important ways. If this is so, then there is the need for government to put deliberate and practical measures in place (through its various anti-graft agencies) to see that its people are financially protected. In this paper, we propose a financial fraud detection structure called Data Mining Incorporation Framework (DMIF) which can be used by the Nigerian government (not restricted to it), through its various anti-graft agencies in its war against frauds.

In this paper, it is established that fraud is really on alarming rating, and this proposed framework would in no small measures assist in the fight against this dreadful menace if applied. The rest of this paper is organised as follow: Section 2 dwells on the review of related literatures; In section 3, the proposed framework is propounded; Section 4 deals with the discussion of results; and the paper is rounded up through conclusion and recommendations in Section 5.

The Review of Related Literatures

In the field of data mining and fraud, a lot of research works are taking place. In this work, a number of literatures have been reviewed in subsections as follow.

Related Works

The role of data mining in financial fraud detection (FFD) cannot be overemphasized, as it is often being applied to extract and uncover the hidden truths behind very large quantities of data. Data mining has been defined as a process of identifying interesting patterns in databases that can then be used in decision making (Bose & Mahapatra, 2001). Turban et al.

(2007) describe data mining as a practice that uses mathematical, machine learning, artificial intelligence and statistical skills to extract and identify useful information and subsequently gain knowledge from a large database. Frawley et al. (1992) opined that the objective of data mining is to obtain valuable, non-explicit information from data stored in large repositories. An important advantage of data mining has been seen as its capability of being used to develop a new class of prototypes to identify new attacks before they can be detected by human experts (Kou et al., 2004).

Quite a great number of publications on the use of data mining techniques in fraud detections are available. All these are efforts expended, or contributions made to fight against the menace of fraudulent practices (particularly the financial ones, which are most rampant) that are ravaging the entire globe. Fraud detection has been identified as one of the best established application areas of data mining in both industry and government (Phua et al., 2005). According to Ngai et al. (2011), financial fraud detection (FFD) is vital to the prevention of the often devastating consequences of financial fraud. He argued that, FFD involves distinguishing fraudulent financial data from authentic ones, thereby disclosing fraudulent behaviours or activities and enabling decision makers to develop appropriate strategies to decrease the impact of the fraud. Rekha (2011) used decision tree and Bayesian Network techniques of data mining, to detect frauds in an auto insurance company. Tarjo and Nurul (2017), analysed the performance of two data mining methods in detecting financial fraud based on Beneish m-score model. The results obtained thereby were found pretty interesting.

The approach here is to use data mining in conjunction with existing procedures (of anti-graft agencies) put in place by Nigerian government. This approach is, however, not restricted to fraud detection application in Nigeria alone.

Fraud Schemes in Nigeria

Jim and Alex (2001) reported that according to the Secret Service, one quarter of the major fraud scams it probes now involve Nigerians, resulting in loss of hundreds of millions of dollars and with United States being the pet target. These frauds have a number of variants, some of which are briefly clarified as follows:

(i) Advance Fee/"419" Scam or Fraud

The most notorious of Nigerian scams is the advanced fee fraud scheme known as the "419"scheme (Jim & Alex, 2001). "The Economist," (2013) describes the number 419 ("four-one-nine") as a verb, a noun, a way of life, a cliché and a curse in Nigeria. It refers to a section of the criminal code that proscribes seeking money for non-existent benefits (FBI, 2013; The Economist, 2013; & Nigerian scams, 2012). A scam victim will usually receive an email making an offer of a large sum of money. While the stories may vary slightly, the general plot then talks of a person who has come across a large sum of money and needs your assistance to get the funds out of the country, with a promise to share in the money.

(ii) Black Money Fraud

A recent variation on the Advance Fee scheme is known as the "black money" scheme. This category of scam is sometimes also known as the "wash scam" (BMS, 2017). It is a scam where con artist attempt to fraudulently obtain money from a victim by persuading him or her that piles of banknote-sized paper in a trunk or a safe is really money which has been dyed, for instance, to avoid detection by security agents. The victim is persuaded to pay for chemicals to wash the "money" with a promise that he will share in the proceeds.

(iii) Access Device Fraud

Access device fraud is another Nigerian fraud. The fraud typically begins with the leasing of a commercial mail box with false name. The crook applies for hundreds of credit cards each day, with the fraud mail box, thereby growing exponentially as the cards arrive (Jim & Alex, 2001). Even though the checks are fraudulent, the credit card companies are required to give immediate credit on the opened account (Jim & Alex, 2001). This allows the thief to obtain even more cash advances and open more bank accounts. Once funded, the criminal forwards a wire transfer order directing the investment company to forward the funds to a bank account under his control.

(iv) Identity theft fraud

Identity theft is one of the frauds prevalent in Nigeria. According to (FBI, 2013), it occurs when someone assumes your identity to perform a fraud or other criminal act. Scandals can get the information they need to assume your identity from a variety of sources, from stealing of wallet through compromising of credit or bank information. You can also be approached in person, by telephone, or on the Internet and ask you for the information.

(v) Bank fraud

These scams are often coordinated with stolen and counterfeit checks. They occupy a large part of the Nigerian fraud space (Jim & Alex, 2001). Armed with computer, and computing facilities, the Nigerian fraudster can print corporate checks in any dollar amount with an authorizing signature that is virtually identical to the original. By recruiting co-conspirators and opening multiple accounts, including some in assumed business names, and a bank insider, an enterprising Nigerian fraudster can operate without fear of getting caught. Once the insider finds an account with a large balance, the account information is compromised and forwarded to the criminal (Jim & Alex, 2001), who issues orders directing the bank to transfer large sums into accounts under his (fraudster) control.

Data Mining Process Model in Financial Fraud Detection

The objective of Data Mining is to find out information with special meaning from large volumes of data using special technologies as the procedure to discover knowledge through data selection – taking out data related to the subject from the database, data pre-processing – putting data in form ready for transformation, data transformation - conversion of the selected data/information into the form appropriate for mining, data mining – extraction of data models by the utilization of technology, pattern evaluation – appraisal of the usefulness of the model to present knowledge, and Knowledge presentation – production of knowledge to the users, using technology such as visual presentation.

The adoption of the mining procedure to discover unknown knowledge and rules from plentiful data is the role of data mining (Han & Kamber, 2001). Consequently, data mining which is part of an iterative process called knowledge discovery in database, would be very useful in extracting knowledge automatically from large volumes (databases) of fraud data from the various sections of fraud, which will be of enormous importance to the various anti-fraud agencies in assisting them to combat the frauds in Nigeria. Data mining has a generic process model it follows in mining data from databases and discovering knowledge successfully for presentation to, and use by users. The anti-fraud agencies can also adopt this process model in order to record success in their struggle to fight this menace. See Figure 1, for a form of a generic process model (James, 2003). Some of the techniques used in data mining in discovering knowledge from the database are enumerated below. The descriptions of these techniques here, are as related to this research work.

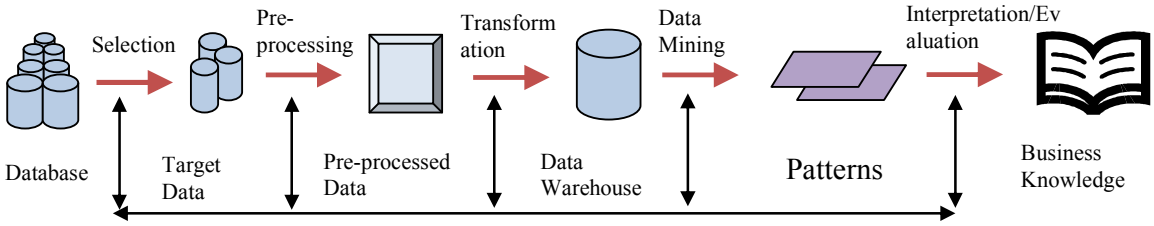

Figure 1: How Data Mining Extracts Business Knowledge from a Data Warehouse

1. Classification

Classification is the most commonly applied data mining technique, which employs a set of pre-classified examples to develop a model that can sort the population of records at large (Bharati, 2010). Fraud detection and credit risk applications are particularly well suited to this type of analysis. For a fraud detection application, this would include complete records of both fraudulent and valid activities determined on a record-by-record basis

2. Clustering

Clustering can be said as identification of similar classes of objects. By using clustering techniques we can further identify dense and sparse regions in object space and can discover overall distribution pattern and correlations among data attributes (Bharati, 2010). For example, to form group of customers based on purchasing patterns, to categorize genes with similar functionality, and to group fraud data.

3. Predication

Regression technique can be adapted for predication. It can be used to model the relationship between one or more independent variables and dependent variables (Bharati, 2010). In data mining, independent variables are attributes already known and dependent variables are what to predict. This model can be adopted to predict fraud data.

4. Association rule

Association and correlation are usually used to find frequent items from among large data sets. This type of finding helps businesses to make certain decisions, such as catalogue design, cross marketing and customer shopping behavior analysis (Bharati, 2010). It is also used to associate fraud data distinguish between fraud and legal data.

5. Neural networks

Neural network is a set of connected input/output units, each with a weight (Bharati, 2010). During the learning phase, network learns by adjusting weights so as to be able to predict the correct class labels of the input data. Neural networks have the remarkable ability to derive meaning from complicated or imprecise data and can be used to extract patterns and detect trends that are too complex. It has particularly been used to distinguish fraud data from legal ones, and in many other application areas.

6. Visualization

Visualization refers to the easily understandable presentation of data and methodology that converts complicated data features into clear patterns so as users can view the complex patterns or relations uncovered in the data mining process (Turban, 2007). The researchers have exploited the pattern detection capabilities of the human visual system by building a suite of system that flexibly encodes data using visual characteristics. Complex patterns are best delivered through the clear presentation of data or function, using visualization techniques (Eick, 2014).

The Research Structure (Framework)

The number of disclosures of frauds linked to Nigeria has remained quite high in recent years Apparao et al. (2009). Criminals perpetrate these acts following certain arrangements. As criminals grow more sophisticated, government (through its anti-graft agencies) must leverage more powerful tactics to keep up. Although, no analytical tool can ever fully replace analysts or investigators, it can suggest which facts stand out and which are most likely to be important in fraud data analysis. As sources of information grow in number, kind and size, what seemed like a "haystack" has started to look like a "mountain" (IBM, 2012).. Data mining techniques have the capacity to deal with large volume of data, analyzing the data and bringing out the various patterns in data. They can group data into various forms to identify variations among them.

Here we present a "Data Mining Incorporated Framework" (DMIF), to aid fraud detection that we hope would assist government to fight frauds through its agencies and others (see Figure 2). Some fraud instances are discussed in section 4. In this approach, data mining techniques (tools) are brought to assist the various agencies and their allies in confronting the danger of frauds. Our approach uses data mining techniques to obtain patterns from large volumes of financial database systems using knowledge discovery process (see Figure 1). From the various financial database systems, data is collected (to obtain target data) and then cleaned. The stage is then set for selection and transformation. The transformed data is stored in a special database called Data Warehouse. Data mining techniques are then applied to extract patterns from the fraud data. The pattern is presented to the experts for evaluation. This process is repeated until found satisfactory. The patterns, if satisfactory become knowledge for usage by the various anti-fraud agents. The various agents take appropriate actions and reviews when necessary. The agents involved in the fight against frauds include; Bank management, Economic and Financial Crimes Commission (EFCC), Independent Corrupt Practices Commission (ICPC), Directorate of Security Service (DSS) and others.

These agents can always sit together to share and review knowledge, to better their knowledge for the challenge before them. This coordinated effort will help in no small measures to fight against the danger of frauds.

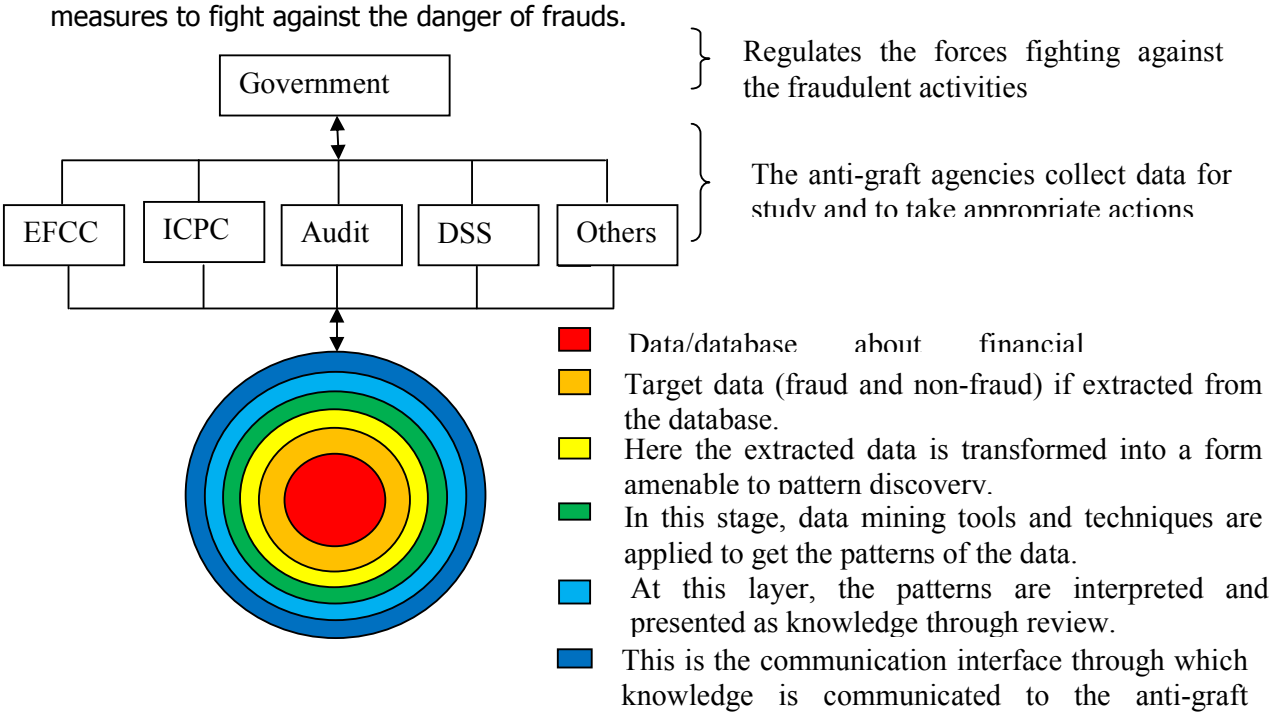

Figure 2: A Data Mining Based Incorporated Framework for Fraud Detection.

Analysis and Discussion of Frauds

Fraud in Nigeria is no longer news to the entire Globe. So many fraud cases in Nigeria including the ones perpetrated against other countries particularly the United States have been reported. Here we analyse and discuss some few cases to appreciate the level of frauds in Nigeria.

The Economic and Financial Crimes Commission (EFCC) reported a case of how a former manager of the defunct Oceanic Bank, Udusegbe Omoefe Eric, allegedly connived with a principal staff of Pension Accounts in the Office of the Head of Service of the Federation (HSF) to steal N1.9 billion pensions in three months (Godwin, 2013).

The Nigerian Deposit Insurance Corporation reported just this year, that the Nigeria Banking Industry recorded 3,380 cases of fraud valued at about ₦18bn, with contingent or expected loss standing at ₦4.52bn, in 2012 alone as against expected loss of ₦4.072bn reported in 2011 (Ifeanyi, 2013). This shows an increase of ₦445m or 10 percent.

According to the Executive Director (Godwin, 2013), Business Development, Nigerian Inter-bank Settlements Systems, NIBSS Plc, the Nigerian Banks have suffered a loss of ₦59 bn to e-frauds between the years 2000 and the first quarter of 2013. For space consideration, we summarize the year by year loss as shown in Figure 3

Table 1: Summary of e-fraud suffered by Nigerian Banks between the years 2000 and 1st quarter of 2013

S/N	Year	Loss (BN Naira)	Change (BN Naira)
1	2000	1.65	
2	2001	3.12	1.47
3	2002	8.2	5.08
4	2003	5.13	-3.07
5	2004	89.43	84.3
6	2005	6.76	-82.67
7	2006	2.74	-4.02
8	2007	8.51	5.77
9	2008	34.5	25.99
10	2009	21.72	-12.78
11	2010	14.96	-6.76
12	2011	24.43	9.47
13	2012	10.06	-14.37
14	2013	7.5	-2.56

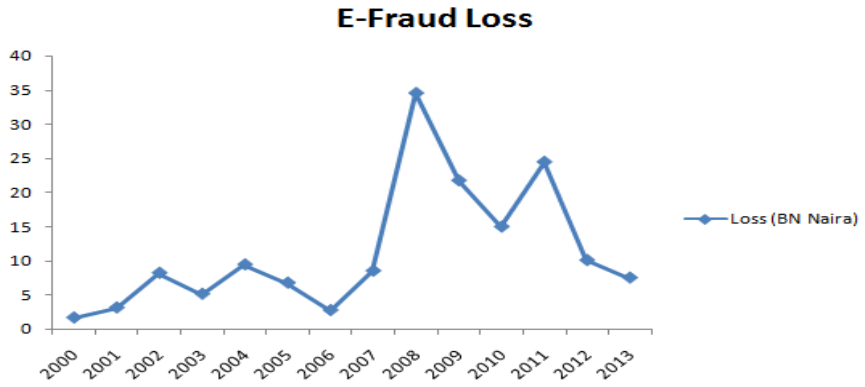

Figure 3: Line Chart of e-fraud suffered by Nigerian Banks between the years 2000 and 2013

All amounts are in Billion Naira (₦). Positive and negative figures in the change column of Table 1 indicate increase and decrease respectively, in the e-fraud of that year from the previous year. Year 2000 has the lowest loss while 2008 has the highest.

Owolabi (2010), reported major fraud and forgery types in Nigerian Banking Industry between 2003 and 2005, from researchers' compilation from Central Bank of Nigeria (CBN) reports of 2003 – 2005 (see Table 2).

Table 2: Compilation from CBN reports: 2003 - 2005

	2003 (₦'M)				2004 (₦'M)				2005 (₦'M)			
Types of Fraud	Freq.	Amount involved	Actual loss	%	Freq	Amount involved	Actual loss	%	Freq	Amount involved	Actual loss	%
Granting of Unauthorized Loans/overdraft	24	222.67	19.45	2.66	25	702.97	59.15	11.32	21	2,601.69	1,413.75	24.53
Presentation of Forged Cheques	249	2,269.91	24.41	27.09	368	1,759.90	547.02	28.33	418	2,632.45	628.82	24.82
Posting of Fictitious Credit	16	93.63	21.58	1.12	58	311.10	88.75	5.01	43	670.31	924.69	6.32
Loss of Money to Armed robbers	40	597.2	81.81	7.13	55	333.87	296.39	5.37	61	566.37	708.07	5.34
Fraudulent Transfer and Withdrawals	283	4,370.2	347.17	52.16	309	2,382.48	560.45	38.36	365	2,673.37	759.10	24.87
Outright Theft	48	179.81	43.55	2.15	49	188.45	45.56	3.03	33	160.15	235.75	1.51
Suppression of Cash/cheques	113	644.51	134.6	7.69	201	532.57	207.10	8.57	171	1,054.25	930.84	3.13
Attempted Fraud									117	331.77	0	3.13
Total	773	8,377.93	857.46	100.00	1,065	6,211.34	1,804.42	100.00	1,229	10.606.18	5,602.02	3.13

Source: Researcher's Compilation from CBN reports 2003 - 2005

With this analysis/discussion (section 4), we can appreciate the level of frauds and fraudulent practices going on in Nigeria. Although, Nigerian Government does not relent in its efforts to fight these criminals, there is the need to strengthen its efforts in order to win the battle against these criminals. It is believed that this methodology, DMIF, coupled with the existing measures, will assist the government, greatly in battling the cheats, since data mining contains such techniques as classification, regression, neural network, clustering, prediction, association rule and visualization, one or more of which have the capacity to detect patterns of any fraud data type. This will help the government to regain its image and win back the confidence of its investors, mainly, the foreign ones.

Conclusion and Recommendation

Fraud incidences have continued to grow in Nigeria despite the efforts from several institutions and anti-graft agencies to fight against these sharp practices. It, therefore, suggests that there is the need to intensify efforts, such as a collaborated and coordinated one like the type suggested by this approach (DMIF). It is suggested in this method that data mining tools or techniques be incorporated into existing framework employed by the various institutions and anti-graft agencies. The incorporation of data mining techniques would better their understandings to readily distinguish between the fraud data and the legal ones. It will also allow all the fraud fighters to communicate in common platform and share ideas easily.

In the findings, it is observed that monetary organizations, particularly the banking sectors are mostly targeted. It is, therefore, suggested that more research efforts in collaboration with the banking sectors and all other stakeholders be geared towards this direction to find a hallmark solution to this danger of frauds. Our further research direction would be direct involvement of the various anti-graft agents involved, and not only rely on the literatures.

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