International Journal of Humanities and Information Technology (IJHIT)
e-ISSN: 2456 –1142, Volume 3, Issue 2 (2018), ijhit.info

Examining the Effectiveness of Forensic Accounting Techniques in Detecting Banking Fraud: A Systematic Review of Existing Evidence

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ABSTRACT

Purpose: Banks remain among the organisations most exposed to occupational and external fraud, and forensic accounting has been widely promoted as a remedy. This paper systematically reviews published evidence, up to and including 2018, on how effective forensic accounting techniques are in detecting fraud in banks and closely related financial institutions.

Design/methodology/approach: Following the evidence-based review logic of Tranfield, Denyer and Smart (2003) and the reporting principles of PRISMA (Moher et al., 2009), peer-reviewed articles, professional reports and authoritative texts were identified through academic databases and reference chaining, screened against explicit inclusion criteria, appraised for methodological quality and synthesised narratively. Twenty-nine core sources formed the final evidence base, supported by related conceptual work on audit, controls and compliance published up to 2018.

Findings: The evidence consistently associates forensic accounting with improved fraud detection and deterrence in banks, but the strength of that evidence varies sharply by technique. Computational techniques (data mining, machine learning and digital analysis such as Benford's Law) have the most rigorous, outcome-based support, largely from card and transaction fraud settings. Investigative and analytical techniques (financial statement and ratio analysis, document examination, interviewing, audit-trail reconstruction) are supported mainly by perception-based surveys, concentrated in Nigeria, that report statistically significant positive associations but rarely measure actual detection outcomes. Professional survey data show that tips remain the single most common means of initial

detection, which positions forensic techniques as complements to, rather than replacements for, whistleblowing and internal controls.

Research limitations/implications: The evidence base is dominated by perception surveys from a single country, so conclusions about individual techniques remain provisional. Five testable propositions are offered to guide outcome-based research.

Practical implications: Banks should combine continuous analytics with trained forensic investigators, whistleblowing channels and strong internal controls, rather than relying on any single technique.

Originality/value: The review organises a fragmented literature into a technique-by-evidence matrix, proposes an integrated conceptual model of forensic fraud detection in banks, identifies the methodological weaknesses that limit current conclusions, and sets out a research and practice agenda for banks and regulators.

Keywords: forensic accounting; banking fraud; fraud detection; Benford's Law; data mining; fraud examination; systematic review

Paper type: Literature review (systematic)

DOI: 10.21590/ijhit.v3.i2.01

1. INTRODUCTION

1.1 Background and research problem

Fraud is one of the most persistent threats to the stability of banking systems. Banks hold and move large volumes of other people's money, depend on public trust, and operate through complex chains of transactions, staff discretion and technology, all of which create opportunities for misappropriation and manipulation. The *Report to the Nations* (Association of Certified Fraud Examiners [ACFE], 2018), based on 2,690 cases from 125 countries, estimated that organisations lose roughly 5% of annual revenue to occupational fraud, with total losses in the studied cases exceeding USD 7 billion and a median loss of USD 130,000 per case. Banking and financial services was the industry most frequently represented in that dataset, a pattern that has recurred across successive editions of the report.

In developing economies the problem is especially acute. Nigerian studies have documented chronic bank fraud driven by weak internal controls, poor staff remuneration, inadequate training, collusion

between insiders and outsiders, and slow judicial processes (Idolor, 2010; Owolabi, 2010; Akinyomi, 2012). Weak budget compliance and statutory reporting across Sub-Saharan Africa compound these problems by reducing the reliability of the records on which detection depends (Dogbatsey & Ebhojie, 2018). Comparable concerns have been raised for India (Bhasin, 2015) and Malaysia (Sanusi, Rameli & Isa, 2015). The recurrence of these failures, together with high-profile corporate scandals, has exposed the limits of the statutory external audit, which is designed to provide reasonable assurance on financial statements rather than to search for concealed fraud (Gray, 2008; Hassink, Meuwissen & Bollen, 2010).

Forensic accounting emerged in response to this gap. It combines accounting, auditing and investigative skills to produce evidence suitable for use in legal proceedings and to uncover, quantify and explain fraud (Singleton & Singleton, 2010; Kranacher, Riley & Wells, 2011). A large body of literature now argues that forensic accounting improves fraud detection, particularly in banks. However, that literature is fragmented across disciplines (accounting, auditing, computer science and criminology), uses very different methods, and is uneven in quality. Claims of effectiveness are often made without distinguishing between techniques or between the types of evidence that support them.

This paper addresses that problem through a systematic review. It asks what the existing evidence actually shows about the effectiveness of specific forensic accounting techniques in detecting banking fraud, how strong that evidence is, and where the gaps lie. The review covers literature published up to and including 2018. The paper proceeds as follows: the remainder of Section 1 sets out the conceptual and theoretical background; Section 2 describes the research method; Section 3 presents the results and discussion, comprising the literature synthesis, a conceptual model with propositions, a technique-by-technique discussion, implications, limitations and directions for future research; and Section 4 concludes.

1.2 Forensic accounting

Forensic accounting is the application of accounting, auditing and investigative skills to matters that may come before a court or other dispute-resolution forum (Kranacher et al., 2011). Its two traditional branches are investigative accounting, which concerns the detection and examination of fraud and financial crime, and litigation support, which concerns the quantification of losses and the presentation of expert evidence (Bhasin, 2007; Nunn, McGuire, Whitcomb & Jost, 2009). Unlike conventional auditing, which works with materiality thresholds and sampling, forensic work assumes that fraud may exist, follows specific allegations or red flags, and seeks evidence that will withstand legal scrutiny (Gray, 2008).

The skills attributed to effective forensic accountants include deductive and critical thinking, investigative flexibility, analytical proficiency, oral and written communication, and an understanding of legal procedure (DiGabriele, 2008; Davis, Farrell & Ogilby, 2010). These skills matter for this review because many forensic "techniques" are not standalone tools but practices whose effectiveness depends on the competence of the person applying them.

1.3 Banking fraud

Banking fraud covers deliberate acts of deception that cause financial loss to a bank, its customers or other stakeholders, or that give the perpetrator an improper benefit. The literature identifies three broad categories. Internal or occupational fraud includes cash theft, fictitious loans, unauthorised withdrawals, manipulation of dormant accounts, and financial statement fraud by management (Owolabi, 2010; ACFE, 2018). Insiders are especially dangerous because legitimate access lets them conceal misuse, which is why insider threat is increasingly modelled as a distinct risk category (Akeju et al., 2018). External fraud includes cheque and document forgery, identity theft, loan fraud and, increasingly, card and electronic payment fraud (Bhattacharyya, Jha, Tharakunnel & Westland, 2011). New products such as distributorship and trade finance facilities widen this exposure as banks pursue growth in emerging markets (Agboada et al., 2018). Collusive fraud involves insiders working with outsiders, and is repeatedly identified as the most damaging form in emerging markets (Idolor, 2010; Akinyomi, 2012). Each category leaves different traces, which is why different forensic techniques are suited to different fraud types.

1.4 Theoretical lenses

Two theories dominate the included literature. The **fraud triangle** (Cressey, 1953) holds that fraud arises when pressure, opportunity and rationalisation coincide. Forensic accounting is usually framed as acting on the opportunity element, by increasing the perceived and actual likelihood of detection. The **fraud diamond** (Wolfe & Hermanson, 2004) adds capability, the personal traits and position that allow an individual to commit and conceal fraud. This extension is especially relevant to banks, where senior officers often have the access and authority to override controls (Abdullahi & Mansor, 2015). Several reviewed studies also draw implicitly on **deterrence theory**: if detection becomes more certain, the expected cost of fraud rises and its incidence should fall (Onodi, Okafor & Onyali, 2015). These theories frame the outcomes examined in this review: detection (finding fraud that has occurred) and deterrence (preventing fraud from occurring).

2. RESEARCH METHOD

2.1 Review approach and questions

The review adopts the systematic, transparent and replicable approach recommended for management research by Tranfield et al. (2003), and follows the reporting principles of the PRISMA statement (Moher et al., 2009) as far as they apply to a review that combines quantitative, qualitative and conceptual sources. Three review questions guided the work:

RQ1. Which forensic accounting techniques have been examined in relation to fraud detection in banks and related financial institutions?

RQ2. What evidence exists on the effectiveness of each technique, and how strong is that evidence?

RQ3. What methodological and contextual gaps limit current conclusions?

2.2 Search strategy

Sources were sought in Google Scholar, Scopus, ScienceDirect, Emerald Insight, JSTOR and African Journals Online (AJOL), supplemented by the publications of the ACFE and by backward and forward reference chaining from key articles. Search strings combined three concept blocks with Boolean operators: ("forensic accounting" OR "forensic audit*" OR "fraud examination" OR "Benford" OR "data mining" OR "machine learning") AND ("fraud" OR "financial crime") AND ("bank*" OR "financial institution*" OR "credit card" OR "microfinance"). The time window ran from 2000 to 2018, with earlier foundational works (for example Cressey, 1953) retained as theoretical anchors rather than as evidence.

2.3 Inclusion and exclusion criteria

Sources were **included** if they (a) examined one or more forensic accounting, fraud examination or fraud analytics techniques; (b) addressed fraud detection or deterrence in banks, other deposit-taking or credit institutions, or payment systems operated by them; or addressed fraud detection generally in a way directly transferable to banking and widely cited in the banking literature; (c) were peer-reviewed articles, scholarly books, or reports from recognised professional bodies; and (d) were published in English. Sources were **excluded** if they were opinion pieces without an analytical basis, duplicated findings already published elsewhere by the same authors, or dealt with fraud outside the financial sector with no stated relevance to banks.

2.4 Screening, appraisal and synthesis

Titles and abstracts were screened first, followed by full-text review. Each retained source was appraised against five criteria: clarity of research question, appropriateness of design, quality of data

and sampling, rigour of analysis, and relevance to banking. On that basis each source was rated as high, moderate or low quality. Low-quality sources were retained where they were the only evidence for a given technique or context, but given less weight in the synthesis. Twenty-nine sources formed the final evidence base. Because the studies differ widely in design, outcome measures and context, statistical meta-analysis was not appropriate; a structured narrative synthesis was used instead, organised by technique.

3. RESULTS AND DISCUSSION

3.1 Literature synthesis: characteristics of the evidence base

Table 1 summarises the included sources. Four features stand out. First, the evidence is geographically concentrated: more than half of the empirical studies come from Nigeria, where bank fraud and forensic accounting have received sustained scholarly attention since the late 2000s. Second, survey designs dominate the accounting literature: most empirical studies collect respondents' perceptions on Likert scales and test associations using chi-square, correlation or regression. Third, computational studies, mainly from computer science and statistics, use transaction datasets and report measurable detection performance, but focus heavily on credit card fraud. Fourth, very few studies anywhere measure actual detection outcomes in banks before and after the adoption of forensic techniques.

Table 1. Characteristics of the 29 included sources

Source	Design	Context	Technique(s)	Main finding	Quality
Owojori & Asaolu (2009)	Conceptual	Nigeria, corporate	Forensic accounting generally	Argues forensic accounting can address corporate fraud failures not caught by statutory audit.	Low
Kasum (2009)	Survey	Nigeria, public and private sectors	Investigation, litigation support	Forensic accounting judged relevant to financial crime; perceived need greater in public sector.	Moderate

Source	Design	Context	Technique(s)	Main finding	Quality
Owolabi (2010)	Survey, descriptive	Nigerian banks	Internal control, investigation	Weak controls and staff collusion are leading causes of bank fraud; stronger investigative capacity recommended.	Moderate
Idolor (2010)	Survey	Nigerian banks	Fraud causes and remedies	Identifies personal and institutional causes; recommends better controls and investigation.	Moderate
Akinyomi (2012)	Survey	Nigerian banks	Prevention and detection controls	Fraud linked to weak controls; calls for improved detection mechanisms.	Low
Izedonmi & Ibadin (2012)	Conceptual	Nigeria	Investigative reasoning	Proposes an inference, relevance and logic approach to forensic investigation.	Low
Okoye & Gbegi (2013)	Survey	Nigeria, public ministries	Forensic accounting generally	Forensic accounting significantly associated with fraud detection and prevention.	Moderate
Enofe, Okpako & Atube (2013)	Survey	Nigeria	Forensic accounting generally	Use of forensic accounting significantly related to fraud detection.	Moderate
Modugu & Anyaduba (2013)	Survey	Nigeria	Forensic accounting generally	Forensic accounting perceived as effective in reducing financial fraud.	Moderate
Eiya & Otalor (2013)	Survey	Nigeria	Forensic accounting generally	Forensic accounting a significant tool against financial crime.	Moderate

Source	Design	Context	Technique(s)	Main finding	Quality
Dada, Owolabi & Okwu (2013)	Survey	Nigeria	Forensic accounting generally	Forensic accounting viewed as a remedy for fraudulent practices.	Low
Gbegi & Adebisi (2014)	Survey	Nigeria, public sector	Skills and techniques	Forensic skills and techniques associated with effective fraud investigation.	Moderate
Onodi, Okafor & Onyali (2015)	Survey	Nigerian banks	Forensic investigative methods	Forensic investigative methods significantly associated with deterrence of corporate fraud in banks.	Moderate
Sanusi, Rameli & Isa (2015)	Survey	Malaysian banks	Fraud schemes, prevention measures	Profiles bank fraud schemes and the controls judged most effective against them.	Moderate
Bhasin (2015)	Survey	Indian banks	Detection and prevention	Reports rising bank fraud and gaps in detection; supports stronger forensic and control measures.	Moderate
Ozili (2015)	Literature review	International	Forensic accounting generally	Synthesises literature; notes limited empirical evidence on actual effectiveness.	Moderate
Ehioghiren & Atu (2016)	Survey	Nigeria	Forensic accounting generally	Forensic accounting positively associated with fraud management.	Moderate
Bhasin (2016)	Survey	India	Forensic accounting and governance	Forensic accounting perceived to strengthen corporate governance and fraud control.	Moderate

Source	Design	Context	Technique(s)	Main finding	Quality
Bassey (2018)	Survey	Nigeria, microfinance institutions	Forensic accounting generally	Forensic accounting significantly associated with fraud management in microfinance banks.	Moderate
Durtschi, Hillison & Pacini (2004)	Methodological	General accounting data	Benford's Law	Sets out when digital analysis is and is not appropriate; useful as a screening tool.	High
Nigrini (2012)	Scholarly book	General, incl. financial data	Benford's Law, digital analysis	Comprehensive treatment of digit tests for detecting anomalies in transaction data.	High
Bolton & Hand (2002)	Review	Banking, cards, telecoms	Statistical fraud detection	Reviews supervised and unsupervised methods; stresses class imbalance and evolving fraud.	High
Ngai et al. (2011)	Systematic review	Financial fraud (49 articles)	Data mining	Classification and clustering most used; credit card and insurance fraud dominate.	High
Bhattacharyya et al. (2011)	Empirical, real transactions	Credit card fraud	Logistic regression, SVM, random forest	Random forests generally performed best; all methods detected fraud above chance.	High
Dal Pozzolo et al. (2014)	Empirical, real transactions	Credit card fraud	Machine learning	Highlights class imbalance, concept drift and alert-based evaluation in practice.	High
West & Bhattacharya (2016)	Systematic review	Financial fraud	Computational intelligence	Many methods effective in studies; real-world deployment and comparability remain issues.	High

Source	Design	Context	Technique(s)	Main finding	Quality
DiGabriele (2008)	Survey	USA	Forensic skills	Identifies skills practitioners and academics consider essential for forensic work.	Moderate
Hassink, Meuwissen & Bollen (2010)	Survey	Netherlands, auditors	Audit-based detection	Auditors' fraud detection depends on procedures and judgement; many frauds found by others.	Moderate
ACFE (2018)	Professional survey	Global, 2,690 cases	Detection methods	Tips are the most common initial detection method; controls and analytics reduce loss and duration.	High

Note: Quality ratings reflect the author's appraisal against the five criteria in Section 2.4.

3.2 Literature synthesis: techniques identified

Across the evidence base, seven families of forensic technique were identified: (1) financial statement and ratio analysis; (2) digital analysis, principally Benford's Law; (3) data mining and machine learning; (4) document examination and audit-trail reconstruction; (5) investigative interviewing and fraud examination procedures; (6) continuous monitoring and data analytics within internal control; and (7) litigation support and expert evidence. Table 2 maps each family against the type and strength of evidence available.

Table 2. Evidence matrix: forensic techniques and strength of supporting evidence

Technique family	Type of evidence	What the evidence suggests	Strength of evidence
Financial statement and ratio analysis	Surveys; conceptual papers; texts	Identifies anomalies in reported figures and trends; widely used in management and loan fraud investigations.	Moderate, mainly perception-based
Digital analysis (Benford's Law)	Methodological studies; texts	Effective screening tool for large populations of naturally occurring numbers; not suited to assigned or capped values.	Moderate to strong for screening
Data mining and machine learning	Empirical studies on real data; systematic reviews	Measurable detection gains on transaction and card fraud; performance sensitive to imbalance and drift.	Strong, but narrow (cards and payments)

Technique family	Type of evidence	What the evidence suggests	Strength of evidence
Document examination and audit trails	Surveys; texts; case-based work	Central to proving forgery, fictitious loans and concealed transfers.	Weak to moderate, rarely measured
Investigative interviewing	Surveys; texts	Valued for confirming suspicions and obtaining admissions; depends on investigator skill.	Weak, perception-based
Continuous monitoring and analytics	Professional surveys	Associated with lower median losses and faster detection.	Moderate, correlational
Litigation support	Surveys; conceptual papers	Improves quantification of loss and prosecution, supporting deterrence.	Weak for detection; indirect

3.3 Literature synthesis: overall direction of findings

Every empirical study in the evidence base reports a positive relationship between forensic accounting and fraud detection, prevention or deterrence. No included study found forensic accounting to be ineffective. This uniformity is itself noteworthy. It may reflect a real effect, but it may also reflect publication bias, the use of respondents who are themselves accountants and therefore predisposed to value forensic methods, and the reliance on perceived rather than observed outcomes. These issues are taken up in Section 3.5.8.

3.4 Conceptual model

3.4.1 An integrated model of forensic fraud detection in banks

The synthesis shows that forensic techniques do not work in isolation. Some screen large populations of transactions before any suspicion exists, others convert suspicion into evidence, and others turn evidence into recovery and sanction. Their effect also depends on conditions outside the techniques themselves, such as the skills of investigators and the quality of internal controls. Figure 1 draws these strands into an integrated model that links fraud drivers, forensic techniques and outcomes.

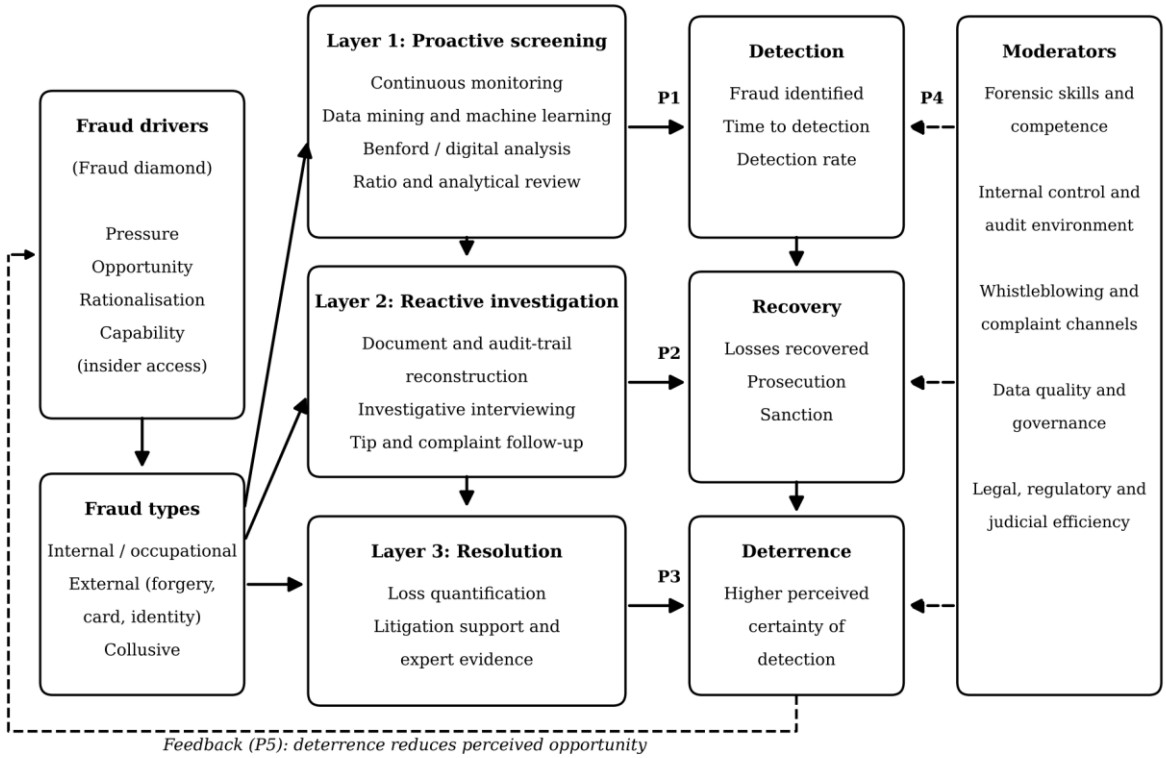


Figure 1. Integrated forensic detection model for banking fraud

Source: developed by the author from the reviewed literature.

The model has four components. The **fraud drivers** on the left follow the fraud diamond (Wolfe & Hermanson, 2004): pressure, opportunity, rationalisation and capability. Capability is emphasised because insiders with legitimate access are the source of much bank fraud (Akeju et al., 2018; ACFE, 2018). These drivers produce internal, external and collusive **fraud types** (Owolabi, 2010; Idolor, 2010).

The centre of the model arranges forensic techniques in three **layers**. Layer 1, proactive screening, covers continuous monitoring, data mining and machine learning, digital analysis and analytical review; these operate on whole populations of data and generate leads (Bolton & Hand, 2002; Nigrini, 2012). Layer 2, reactive investigation, covers document and audit-trail reconstruction, interviewing and follow-up of tips and complaints; these confirm or reject leads and build evidence (Kranacher et al., 2011; Albrecht et al., 2012). Layer 3, resolution, covers loss quantification, litigation support and expert evidence (Kasum, 2009). The layers are sequential: screening feeds investigation, and investigation feeds resolution.

On the right are three **outcomes**: detection, recovery and sanction, and deterrence. Detection is the primary outcome of Layer 1, recovery of Layer 2, and deterrence of Layer 3, although each layer contributes to all three. A set of **moderators** conditions the strength of every link: forensic skills and

competence (DiGabriele, 2008), the internal control and audit environment (Akomolafe & Agu, 2018; Owolabi, 2010), whistleblowing and complaint channels (ACFE, 2018; Adeyelu, 2018), data quality and governance (Mbonu et al., 2018; Dogbatsey & Ebhojie, 2018), and legal, regulatory and judicial efficiency (Idolor, 2010; Uchechi, 2018). Finally, a **feedback loop** links deterrence back to the opportunity element of the fraud drivers, reflecting deterrence theory (Onodi et al., 2015).

3.4.2 Propositions

The model yields five propositions that can be tested in future research:

- **P1.** Proactive screening techniques (continuous monitoring, machine learning and digital analysis) increase the rate and speed of fraud detection in banks, with the largest effects for high-volume transaction and card fraud.
- **P2.** Reactive investigative techniques (audit-trail reconstruction, document examination and interviewing) increase the proportion of detected frauds that result in recovery of losses and successful sanction.
- **P3.** Litigation support and credible expert evidence strengthen deterrence by raising the perceived certainty and severity of punishment.
- **P4.** The effects in P1 to P3 are stronger where forensic skills, internal controls, whistleblowing channels, data governance and judicial efficiency are stronger.
- **P5.** Over time, higher deterrence reduces perceived opportunity, lowering the incidence of internal and collusive fraud.

The model is grounded in the reviewed evidence but is not itself tested here. Its value lies in making explicit the relationships that the existing literature assumes but seldom measures.

3.5 Discussion of forensic techniques

3.5.1 Financial statement and ratio analysis

Analytical review of financial statements, including horizontal, vertical and ratio analysis, is one of the oldest forensic tools. In banks it is used to spot unusual growth in loans or deposits, unexplained changes in non-performing loan ratios, inconsistencies between interest income and loan balances, and other signals of manipulation or concealed losses (Albrecht, Albrecht, Albrecht & Zimbelman, 2012; Kranacher et al., 2011). The Nigerian survey literature consistently reports that respondents regard such analysis as an effective element of forensic accounting (Enofe et al., 2013; Modugu & Anyaduba, 2013). However, these studies rarely isolate ratio analysis from forensic accounting as a whole, so its specific contribution cannot be estimated. Its value appears greatest for management-

level and financial statement fraud, and lowest for small, high-volume frauds that do not move aggregate figures. Its effectiveness also depends on credible expectations: forecasting and financial analytics models supply the baselines against which unusual results can be judged (Lawal & Oduleye, 2018a; Unamma et al., 2018), and compliance analytics extend the same logic to tax and cross-border reporting (Lawal & Oduleye, 2018b).

3.5.2 Digital analysis and Benford's Law

Benford's Law predicts the frequency of leading digits in many naturally occurring datasets. Deviations from the expected distribution can signal fabricated, altered or threshold-avoiding figures (Nigrini, 1999, 2012). Durtschi, Hillison and Pacini (2004) provide the most cited guidance on its appropriate use, showing that the method works best on large datasets of transaction-level amounts that are not assigned numbers, are not constrained by minimums or maximums, and arise from the combination of several factors. For banks, suitable populations include disbursements, journal entries, expense claims and transfers. Unsuitable populations include account numbers, fixed fees and amounts capped by policy.

The evidence supports Benford analysis as an efficient **screening** technique rather than a detection technique in the strict sense: it identifies where to look, not whether fraud has occurred. It also cannot detect frauds that leave digit patterns unchanged, such as theft through a few large, plausibly valued transfers. No included study measured its detection rate specifically in a bank, which is an important gap.

3.5.3 Data mining and machine learning

The strongest outcome-based evidence in the review comes from computational fraud detection. Bolton and Hand (2002) set out the core distinction between supervised methods, which learn from labelled fraud cases, and unsupervised methods, which flag unusual behaviour without labels, and they emphasise practical challenges such as highly imbalanced data and fraudsters who adapt. Ngai, Hu, Wong, Chen and Sun (2011), reviewing 49 articles, found that classification techniques such as neural networks, decision trees, logistic models and Bayesian networks were most widely applied, and that credit card fraud was among the most studied fraud types. West and Bhattacharya (2016) reached similar conclusions and noted persistent problems with comparability across studies and with real-world deployment.

Among primary studies, Bhattacharyya et al. (2011) compared logistic regression, support vector machines and random forests on real international credit card transactions and found that random

forests generally gave the best overall performance, while all methods offered meaningful detection capability. Dal Pozzolo, Caelen, Le Borgne, Waterschoot and Bontempi (2014), working with practitioner data, showed that performance depends heavily on how class imbalance and concept drift are handled, and that evaluation measures must reflect the limited number of alerts investigators can actually review.

This body of work demonstrates that analytical techniques can detect banking fraud at scale with measurable accuracy. Two cautions apply. First, the evidence concerns mainly card and payment fraud, not insider fraud, loan fraud or financial statement manipulation. Second, these are often built and run by data scientists rather than forensic accountants, raising the question of whether they belong within forensic accounting or alongside it. Their use of customer data must also respect legal and ethical limits on data processing (Mbonu et al., 2018). The emerging view in the literature is that they are most effective when combined with forensic judgement: models generate alerts, and forensic professionals investigate, document and build cases from them.

3.5.4 Document examination and audit-trail reconstruction

Much banking fraud, including forged cheques, fictitious loan files, unauthorised withdrawals and manipulation of dormant accounts, is ultimately proved through documents and transaction trails (Owolabi, 2010; Singleton & Singleton, 2010). Forensic accountants trace funds through accounts, reconcile records with source documents, and reconstruct the sequence of events, often using techniques such as net worth analysis or source and application of funds analysis (Albrecht et al., 2012). Surveys of Nigerian bank staff and auditors rate these investigative methods highly, and Onodi et al. (2015) report that forensic investigative methods are significantly associated with deterrence of corporate fraud in Nigerian banks. Yet the evidence is almost entirely perceptual. No included study compared, for instance, recovery rates or conviction rates in cases with and without forensic audit-trail work. Offline assessments of directory and access systems show how access records can themselves be examined to reconstruct who did what inside an institution (Ladapo et al., 2018).

3.5.5 Investigative interviewing and fraud examination procedures

Structured interviewing, from neutral witnesses through to the suspect, is a standard part of fraud examination (Kranacher et al., 2011). It is valued for corroborating documentary evidence and for obtaining admissions. Gbegi and Adebisi (2014) and DiGabriele (2008) identify interviewing and communication as core forensic competencies. The effectiveness of interviewing depends so heavily on the individual examiner that it is difficult to study as a technique. The evidence in this review

supports its importance in completing investigations but says little about its contribution to the initial detection of fraud.

3.5.6 Continuous monitoring, controls and the role of tips

The ACFE (2018) data provide the most useful global benchmark. Tips were the most common initial detection method, accounting for roughly 40% of cases, far ahead of internal audit, management review and other methods. Proactive data monitoring and analysis, surprise audits and hotlines were associated with lower median losses and shorter fraud durations. These findings have two implications. First, forensic techniques rarely act alone at the point of first detection; they are often triggered by a tip and then used to confirm and quantify the fraud. Second, the techniques that most clearly reduce loss are those embedded in routine operations, such as continuous transaction monitoring, rather than those used only after suspicion arises. Hassink et al. (2010) similarly found that many frauds are discovered by parties other than auditors, reinforcing the importance of combining forensic capability with reporting channels and controls. Technology-enabled risk assessment has been proposed as a way to raise internal audit quality in this respect (Akomolafe & Agu, 2018), and work in other regulated sectors shows that complaint data can be monitored predictively to surface systemic risks early, a logic that applies equally to customer complaints in banks (Adeyelu, 2018).

3.5.7 Litigation support and deterrence

Litigation support does not detect fraud directly, but it affects the consequences of detection. Clear quantification of loss and credible expert evidence improve the prospects of prosecution and recovery, which in deterrence terms raises the expected cost of fraud (Kasum, 2009; Owojori & Asaolu, 2009). Structured approaches to managing legal and financial exposure, including defence against litigation, show how evidence quality shapes outcomes once disputes arise (Uchechi, 2018). Several Nigerian studies argue that weak prosecution and long court delays undermine the deterrent effect of detection (Idolor, 2010; Akinyomi, 2012). The evidence here is conceptual and perceptual, and causal effects on fraud incidence have not been demonstrated.

3.5.8 Strength and limits of the evidence

Taken together, the evidence supports a qualified conclusion: forensic accounting techniques are associated with better detection and deterrence of banking fraud, but the strength of that association has been demonstrated rigorously only for a subset of techniques and fraud types. Several methodological weaknesses run through the literature:

- **Perceived rather than measured outcomes.** Most accounting studies ask respondents whether forensic accounting is effective, rather than measuring detection rates, losses, recoveries or time to detection.
- **Common-method and respondent bias.** Independent and dependent variables usually come from the same questionnaire, and respondents are often accountants or auditors with a professional interest in forensic accounting.
- **Weak construct definition.** Forensic accounting is frequently measured as a single construct, preventing assessment of individual techniques.
- **Limited sector focus.** Many studies sample public-sector or mixed organisations, so banking-specific conclusions rely on a small number of studies such as Owolabi (2010), Onodi et al. (2015) and Bassey (2018).
- **Narrow computational scope.** Outcome-based machine learning evidence concentrates on card fraud and seldom addresses insider fraud or loan fraud.
- **Absence of cost-effectiveness evidence.** No included study weighed the cost of forensic capability against the losses it prevents or recovers.

These limitations do not mean forensic accounting is ineffective. They mean the literature has not yet produced the kind of evidence needed to rank techniques or to justify specific investments with confidence.

3.6 Implications

3.6.1 Theoretical implications

The review supports the use of the fraud triangle and fraud diamond as lenses for banking fraud, but it shows that the literature has mostly treated forensic accounting as acting on a single element, opportunity. The model in Section 3.4 extends this view in two ways. First, it distinguishes between techniques that detect, those that recover and those that deter, which the literature usually treats as one construct (Enofe et al., 2013; Modugu & Anyaduba, 2013). Second, it introduces moderators, recognising that the same technique may be effective in one control and legal environment and ineffective in another. This contingency view offers a way to reconcile the strong perceived effectiveness reported in surveys with the limited outcome evidence available.

3.6.2 Practical implications for banks

- Embed continuous, analytics-based transaction monitoring, with alerts routed to trained forensic investigators rather than handled only by automated rules (Dal Pozzolo et al., 2014).

- Establish or strengthen in-house forensic units with clear mandates covering insider and loan fraud, not only card and payment fraud (Akeju et al., 2018; Onodi et al., 2015).
- Apply digital analysis, including Benford tests, routinely to suitable populations such as expense claims, disbursements and journal entries (Durtschi et al., 2004).
- Link forensic work to well-publicised whistleblowing and complaint channels and protect those who report (ACFE, 2018; Adeyelu, 2018).
- Use technology-enabled risk assessment to raise internal audit quality, and protect the integrity of access logs and audit trails (Akomolafe & Agu, 2018; Ladapo et al., 2018).
- Invest in forensic skills training and certification for internal auditors and compliance staff (DiGabriele, 2008; Davis et al., 2010).

3.6.3 Policy and regulatory implications

- Regulators should collect and publish standardised data on bank fraud detection methods, losses and recoveries to enable independent evaluation of forensic techniques.
- Supervisory frameworks should require banks to document their fraud detection architecture, including screening tools, investigative capacity and escalation routes.
- Judicial reform to shorten fraud trials would strengthen the deterrent link between detection and sanction (Idolor, 2010; Akinyomi, 2012).
- Data protection rules should be clarified so that banks can use customer data for fraud analytics lawfully and transparently (Mbonu et al., 2018).

3.7 Limitations of the review

This review has its own limitations. It was restricted to English-language sources, which may have excluded relevant work from francophone Africa, Latin America and parts of Asia. Grey literature from banks and regulators, including internal forensic reports, is largely unavailable to researchers and is therefore under-represented. Screening and quality appraisal were conducted by a single reviewer, which increases the risk of subjective judgement; independent double-coding would strengthen future reviews. Finally, the heterogeneity of designs and outcomes made meta-analysis inappropriate, so the conclusions rest on narrative synthesis.

3.8 Directions for future research

The gaps identified in this review point to a clear research agenda:

- **Outcome measures.** Use detection rates, time to detection, losses and recoveries, ideally with before-and-after or comparison-group designs, instead of perceived effectiveness.
- **Technique-level evidence.** Study individual techniques separately rather than treating forensic accounting as one construct, so that their relative contributions can be compared.
- **Broader fraud types.** Extend computational studies beyond card fraud to insider, loan and financial statement fraud in banks.
- **Stronger designs.** Use multiple data sources to reduce common-method bias, for example combining surveys with bank records, regulator data or court files.
- **Testing the model.** Test propositions P1 to P5, in particular the moderating role of controls, skills, whistleblowing, data governance and judicial efficiency, using cross-country samples.
- **Cost-effectiveness.** Examine whether the cost of forensic capability is justified by the losses it prevents or recovers.
- **Wider contexts.** Replicate studies outside Nigeria, including francophone Africa, Asia and Latin America, and in microfinance and digital-only banks.

4. CONCLUSION

This review set out to examine the effectiveness of forensic accounting techniques in detecting banking fraud. The evidence consistently points in a positive direction. Computational techniques, especially machine learning on transaction data, have the strongest measured support. Digital analysis is well established as a screening tool. Investigative techniques such as ratio analysis, document and audit-trail examination, and interviewing are widely regarded as effective and are essential for converting suspicion into evidence, but their effectiveness has mostly been asserted through perception surveys rather than demonstrated through outcome data. Tips remain the leading source of initial detection, so forensic accounting works best as part of an integrated system with whistleblowing channels and strong internal controls.

The integrated model developed in this paper captures that system: proactive screening, reactive investigation and resolution work in sequence, and their effect depends on the skills, controls, reporting channels, data and legal environment in which they operate. Until outcome-based evidence is available, the most defensible position is that forensic accounting is a valuable and probably effective response to banking fraud, whose benefits are greatest when its techniques are combined with one another and with strong organisational controls.

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