

HARNESSING ARTIFICIAL INTELLIGENCE, BIG DATA, AND FORENSIC INVESTIGATION IN TAX INVESTIGATION AND AUDIT FUNCTIONS: A NEW FRONTIER IN COMPLIANCE ENFORCEMENT

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Abstract

The deployment of Artificial Intelligence (AI), Big Data analytics, and forensic investigation in tax administration marks a new frontier in compliance enforcement. These tools enable tax authorities to detect anomalies, reconstruct fraudulent transactions, and streamline tax investigation and audit functions with greater accuracy and efficiency. Drawing on global case studies from South Africa, India, the United States, Norway, Uganda, and the United Kingdom, and linking them to Nigeria's emerging practices under the Federal Inland Revenue Service (FIRS), Economic and Financial Crimes Commission (EFCC), and Independent Corrupt Practices Commission (ICPC), this paper examines how AI, Big Data, and forensic investigation drive enforcement, enhance fraud detection, improve audit outcomes, and support real-time compliance monitoring. While benefits are clear, challenges remain in data protection, algorithmic bias, and transparency. The study recommends capacity building, robust data governance, and the integration of forensic units into Nigeria's tax enforcement landscape to strengthen compliance and revenue mobilization.

Keywords: *Artificial Intelligence, Big Data, Forensic Investigation, Forensic Accounting, Tax Investigation, Tax Audit, Compliance Enforcement, Nigeria*

INTRODUCTION

Tax authorities worldwide are leveraging Artificial Intelligence (AI) and Big Data analytics to modernize compliance enforcement. For Nigeria, where tax evasion, under-reporting of income, and the growth of the informal and digital economies persist, these technologies offer transformative opportunities.

Forensic investigation which include forensic accounting, digital forensics, and investigative analysis is already made a key part of Nigeria's anti-fraud landscape. This could fortify compliance in the Nigeria tax system. Agencies such as the **EFCC** and **ICPC** apply forensic techniques to track illicit flows, while FIRS has introduced **TaxPro-Max** and **e-invoicing systems** to curb VAT and transfer pricing fraud. Combining forensic expertise with AI and Big Data can elevate Nigeria's tax enforcement to international best practice.

Literature Review

In course of organising this paper, some literatures were reviewed to ascertain the level of adoption of AI, BigData and Forensic investigation as tools for tax compliance. The following literatures were reviewed:

1. The OECD (2016, 2023) emphasizes advanced analytics as a driver of compliance modernization.
2. Professional insights (Thomson Reuters, 2024, 2025; Wolters Kluwer, 2025) highlight AI's transformative impact on audit efficiency.
3. Empirical studies (Alexopoulos et al., 2021; Tagliaferri et al., 2019) confirm the success of machine learning in VAT fraud detection and ;
4. Zheng et al. (2020) caution about ethical pitfalls.

In Nigeria, scholars and practitioners note the rise of forensic approaches in financial crimes enforcement. Crumbley, Heitger, & Smith (2019) and Bologna & Lindquist (1995) highlight forensic accounting as critical in reconstructing financial evidence. Locally, EFCC reports have shown how forensic document analysis and digital forensics strengthen prosecutions in tax-related fraud cases.

METHODOLOGY

The study adopts a comparative case-study approach, drawing on:

- OECD and professional reports on AI in tax enforcement.
- Practices of South Africa, India, Norway, Uganda, the United States, and the United Kingdom.
- Nigerian initiatives including FIRS TaxPro-Max, e-invoicing, EFCC forensic accounting practices, and ICPC collaboration in tax-related corruption cases.

This mixed evidence is analyzed for relevance to Nigeria's fiscal enforcement challenges.

Findings

Contributions of AI, Big Data, and Forensic Investigation

- **Predictive Risk Assessment:** The IRS and Norway use machine learning to flag high-risk taxpayers. Nigeria's FIRS has begun integrating predictive analytics into TaxPro-Max to flag VAT fraud.
- **Anomaly Detection:** India's GSTN uncovers invoice fraud; similarly, Nigeria's **e-invoicing platform (Export Proceeds Form "NXP")** aims to detect trade mispricing.
- **Audit Efficiency:** AI-assisted audit trails improve efficiency in Hong Kong. In Nigeria, EFCC's forensic labs strengthen audit trails in financial crimes.
- **Forensic Accounting:** Used in Nigeria by EFCC and ICPC to reconstruct fraudulent books and detect overstatement of expenses.
- **Digital Forensics:** Applied globally to cryptocurrencies; in Nigeria, EFCC recently investigated crypto-related tax evasion using forensic blockchain analytics.
- **Real-Time Monitoring:** FIRS's TaxPro-Max offers near real-time filing and monitoring, mirroring OECD standards.

Global and Nigerian Case Studies

- **South Africa (SARS):** Machine learning plus forensic audits recovered ZAR 10 billion in VAT fraud.
- **United Kingdom (HMRC):** The AI-driven "Connect" system integrates financial and forensic data for audits.
- **Uganda (URA):** Big Data analytics enhanced fraud detection.
- **Nigeria (FIRS/EFCC/ICPC):**
 - **FIRS TaxPro-Max** introduced predictive analytics for VAT filing irregularities.
 - **E-invoicing system** addresses transfer pricing and trade mispricing.
 - **EFCC forensic units** investigate financial crimes, including tax fraud, by reconstructing financial statements and analyzing bank records.
 - **ICPC collaborations** link forensic evidence of procurement fraud to tax evasion cases.

DISCUSSION

Global evidence shows that AI and Big Data improve efficiency, while forensic investigation ensures accuracy, credibility, and prosecutorial strength.

For Nigeria:

- **Data Protection:** The NDPR (Nigeria Data Protection Regulation) is still weak for tax data governance.
- **Capacity Gaps:** FIRS lacks sufficient AI/data science specialists; forensic accountants are concentrated in EFCC rather than tax administration.
- **Transparency:** Taxpayer trust may be undermined unless AI outputs are explainable and forensic evidence transparent.

A **hybrid enforcement model** is required:

- AI and Big Data drive anomaly detection and risk scoring.
- Forensic investigation contextualizes findings, reconstructs records, and ensures admissibility in Nigerian courts.

CONCLUSION AND RECOMMENDATIONS

AI, Big Data, and forensic investigation are necessities for Nigeria's tax modernization. Their synergy offers efficiency, credibility, and stronger compliance enforcement.

Recommendations:

1. Establish **FIRS Forensic Investigation Units**, staffed with forensic accountants, digital forensic analysts, and data scientists.
2. Strengthen the **NDPR and Evidence Act** to cover algorithmic accountability and digital forensics in tax cases.
3. Build capacity through training programs at **Nigerian universities** and professional institutes (CITN, ICAN, ANAN, CICFIN) on forensic accounting and AI analytics.
4. Expand **TaxPro-Max** to integrate forensic data matching across banks, Corporate Affairs Commission, and Customs.
5. Foster **FIRS–EFCC–ICPC collaboration** in tax enforcement by sharing forensic evidence and joint taskforces.
6. Pilot **forensic-AI audits in VAT and transfer pricing**, then scale to personal income and corporate tax.
7. Partner with OECD and ATAF (African Tax Administration Forum) for technical assistance and forensic audit benchmarking.

By implementing these measures, Nigeria can modernize tax enforcement, curb evasion, and strengthen fiscal integrity while ensuring legal credibility.

REFERENCES (APA)

- Alexopoulos, A., Dellaportas, P., Gyoshev, S., Kotsogiannis, C., Olhede, S. C., & Pavkov, T. (2021). *A network and machine learning approach to detect Value Added Tax fraud*. arXiv. <https://arxiv.org/abs/2106.14005>
- Bologna, G. J., & Lindquist, R. J. (1995). *Fraud Auditing and Forensic Accounting*. Wiley.
- Crumbley, D. L., Heitger, L. E., & Smith, G. S. (2019). *Forensic and Investigative Accounting*. CCH.
- OECD. (2016). *Advanced Analytics for Better Tax Administration: Putting Data to Work*. OECD Publishing. <https://doi.org/10.1787/9789264256453-en>
- OECD. (2023). *Tax Administration 2023: Comparative Information on OECD and other Advanced and Emerging Economies*. OECD Publishing. <https://doi.org/10.1787/900b6382-en>
- Tagliaferri, G., Scacciatelli, D., & Alaimo Di Loro, P. F. (2019). *VAT tax gap prediction: A 2-step Gradient Boosting approach*. arXiv. <https://arxiv.org/abs/1912.03781>
- Thomson Reuters. (2024). *How AI transformed the tax and accounting profession in 2023*. Thomson Reuters Tax & Accounting.
- Thomson Reuters. (2025). *How AI will impact the tax and accounting profession*. Thomson Reuters Tax & Accounting.
- Wolters Kluwer. (2025). *The power of AI: What accounting and tax professionals need to know*. Wolters Kluwer Expert Insights.
- Zheng, S., Trott, A., Srinivasa, S., Naik, N., Gruesbeck, M., Parkes, D. C., & Socher, R. (2020). *The AI Economist: Improving Equality and Productivity with AI-driven Tax Policies*. arXiv. <https://arxiv.org/abs/2004.13332>