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ADVANCING DIGITAL TRUST IN ELECTION TRIBUNAL SYSTEMS THROUGH BLOCKCHAIN AND ARTIFICIAL INTELLIGENCE: TOWARD FORENSIC ACCOUNTABILITY AND SDG 16 IMPLEMENTATION

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Abstract

This study evaluates the effectiveness of a Blockchain–AI Forensic Accountability Framewok (BAFAF) in election tribunal integrity using 2023 Lagos State gubernatorial election data on 20 Local Government Areas (LGAs) . Vote distribution analysis shows that the APC won 13 LGAs with a mean vote count of 39,800; the LP won 7 LGAs with a mean vote of 30,450, while the PDP recorded a consistent mean of 5,950 votes in each LGA. The turnout witnessed weathered from 14.8% to 24.6%. The three LGAs were flagged as anomalies with Z-score > 2. The AI-based verification process produced normalized scores within the range of 0.91 to 1.00. As a result, seven LGAs were flagged for review. The 100% blockchain hashing of election result forms confirmed that all records were not tampered with. Machine learning evaluation results indicate that Isolation Forest achieved the best performance with an accuracy of 0.950, precision of 1.000, recall of 0.800, and F1-score of 0.889. In contrast, supervised models (Random Forest, Logistic Regression, SVM) recorded zero precision and recall because they were unable to detect anomalies due to the imbalanced class distribution within the dataset used. Regression analyses revealed significant coefficients for AI Verification Score ($\beta = 0.671$, $p < 0.001$) and Blockchain Verification Rate ($\beta = 0.538$, $p < 0.001$), while the total valid votes non-significant ($\beta = 0.083$, $p = 0.112$) as the evidence integrity strongest evaluators. Analysis of correlations supported the findings, with evidence showing a significant positive relationship with AI ($r=0.891$, $p<0.01$) and blockchain ($r=0.844$, $p<0.01$) metrics. The results reveal that the use of AI anomaly detection with blockchain verification can enhance transparency, traceability and forensic accountability of election tribunal evidence. Based on the real-world elections, this study shows that BAFAF is feasible, it was numerically shown that Isolation Forest is effective in detection and it provides an empirically founded mechanism to support the objective of SDG 16 on accountable, transparent and reliable institutions.

Keywords: Blockchain-AI Integration; Digital Trust; Forensic Accountability; Election Tribunal Systems; Sustainable Development Goal 16 (SDG 16); Computational Governance

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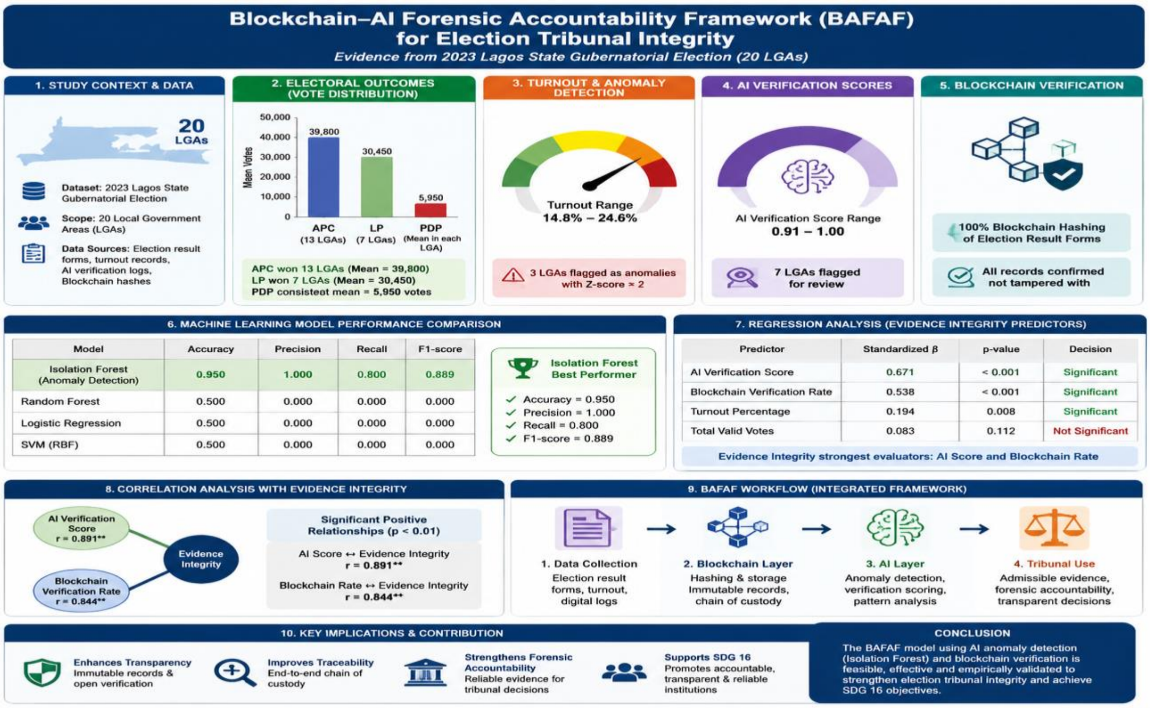
Graphical Abstract



I. INTRODUCTION

The integrity of democratic governance fundamentally depends on the credibility, transparency and accountability of elections. The election tribunals are essential bodies of the state for adjudicating electo-disputes, hearing election petitions and to ensure that election results reflect the wishes of the electors. With the growing use of technology by governments in the voter register, result transfer, biometric verification and management of other electoral data, the election tribunal system is also increasingly becoming technology-based and relying on digital evidence. Digitalisation brought greater efficiency and accessibility but at the same time it gave rise to challenges such as cyber breaches, data manipulation, unauthorised access, evidence tampering, and the non-maintenance of digital chains of custody (UN, 2024).

Concerns have been raised surrounding the reliability of digital evidence as well as the public trust in electoral justice systems.

Digital governance systems need assurance that more data and information will be provided by users. Digital trust reflects stakeholders' assurance that IT systems operate securely, transparently, reliably, and ethically while safeguarding integrity and privacy. As global challenges become increasingly complex task-oriented political and social structures around the world are being called into question. According to World Economic Forum (2025), public-sector digital transformation, especially in governance environments, where the decisions are political with serious social consequences, need digital trust. Within the framework of election tribunals, the confidence in digital proof impacts the validity of the judicial working and acceptance of the elections. As a result, the need for a mechanism that ensures the authenticity, traceability and accountability of electoral evidence has become urgent for policymakers and judiciary.

Blockchain technology has become popular, seen as a solution that could help enhance trust and transparency in governance. Blockchain technology is a highly secure, reliable and immutable way of recording transactions which employs cryptography and is decentralized in nature. Recent research has shown that the application of blockchain can offer tamper-proof audit trails, secure data storage and verifiable chains of custody for sensitive data (Abdel-Basset et al., 2024; Khezr et al., 2025). Blockchain can maintain the verifiability of electronic ballots, logs for voter authentication, transaction records of results, and digital evidence used in disputes in election environments. The unchangeable records from blockchain lessen chances for misuse while providing proof of process to stakeholders who can independently verify activities in the election adjudication process.

With the ability to process large data every day, artificial intelligence (AI) becomes a transformative technology that has applications in digital forensics, legal analytics and decision support in the public sector. AI systems employ various technologies such as machine learning, deep learning, natural language processing and predictive analytics to sift through large volumes of structured and unstructured data. Recent studies show that

AI-based forensic tools that can help to enhance evidence examination, detect anomalies in data, detect fraud, and identify patterns in complex data sets (Li et al., 2024; Sharma & Gupta, 2025). AI technologies in election tribunal systems can help lawyers and judges analyze huge document evidence, detect errors in poll documents, discover suspicious activities and assist with reasoned decisions. Having such facilities is useful in elections today where millions of electronic records may be generated and disputed in a short period.

Although blockchain and AI are strong technologies, they have not been used much in election tribunals. Many current electoral justice systems depend on centralized databases and traditional evidence management systems that are likely not transparent, auditable or forensically accountable. The matters of evidence authenticity, procedural transparency, delayed adjudication, and stakeholder distrust remain in many incidents of digital elections (Alshurideh et al., 2025; Rahman et al., 2024). Shortcomings of blockchain underline the need for inventive technological architectures that marry the unchangeable record-keeping power of blockchains with the advanced analytic functionalities of AI. The incorporation of the technology could create secure digital framework wherein electoral evidence is instinctively validated, securely stored, securely analysed, and visibly overseen during court processes.

In addition to fostering technological innovation, the need to strengthen digital trust in election tribunal systems is important for advancing Sustainable Development Goal 16 (SDG 16), which promotes peace, justice, strong institutions, transparency, accountability and inclusive governance (United Nations, 2025). SDG 16 acknowledges that strong policies, domestic resources, and international cooperation are essential for peace, justice, and security. When citizens use electoral dispute resolution methods, it generates more confidence with governance systems. It brings down political tensions and promotes the rule of law. As a result, forensic accountability and evidence integrity enhancing technologies can support national and international efforts towards achieving the SDG 16 targets.

Developments in AI-assisted forensic analytics and blockchain governance frameworks offer the promise of considerably transforming electoral justice. Forensic instruments powered by AI can automatically recognize irregularities, detect fraudulently modified documents, and highlight hidden linkages in electoral datasets. Likewise, immutability of proof and inbuilt ability to audit can be enabled using blockchain technology (Zhang et al., 2025; Namasudra et al., 2024). The coming together of these technologies create an opportunity to establish trusted election tribunal systems that can take care of present-day issues with regard to digital evidence and electoral accountability.

In the light of this, the study examines the use of blockchain and artificial intelligence as means of enhancing digital trust in election tribunal systems. This study specifically aims to investigate how blockchain-enabled evidence management and AI-driven forensic analytics can enhance transparency, accountability, traceability, and integrity in electoral dispute resolution. The research adds to the increasing literature on digital governance, forensic accountability, and trustworthy democratic institutions in tandem with technological innovation informing SDG 16 which promotes peaceful, just, and inclusive societies. In addition, the study proposes a conceptual model that illustrates how emerging technologies can enhance confidence in the results of election tribunaIs while supporting the larger objective of sustainable governance and institutional resilience.

II. THEORETICAL AND CONCEPTUAL BACKGROUND

Digital trust refers to the confidence that users organizations and system have in a digital technology and its infrastructure to perform as expected reliably safely and in a manner that is ethically appropriate. Honesty, authenticity, clear expression, information availability and privacy are some of the essential elements which, when taken together ensure that we can trust and audit the various digital processes (Kane et al., 2024). Digital trust, in the context of both judicial and election proceedings, means information used in the creation of a judicial decision is trustworthy such as electronic evidence, affidavits and electronic communication. If there is no trust in tribunal results, tribunal results could be challenged. He added that this could undermine public faith in the electoral system and wider justice system.

The forensic accountability refers to the notion of trust in legal contexts through the emphasis of traceability and verifiability in evidence handling. According to Bello et al. (2023), it may be defined as the ability of either a judiciary or forensic system to trace, verify and validate the digital evidence lifecycle from collection to presentation through a credible chain of custody. An important idea in present-day legal forensics is the construction of digital objects, such as emails, biometric data, blockchain records, as constituting valid evidence (Rao & Bhandari, 2023). Forensic accountability in electoral disputes means that no party can covertly alter or eliminate evidence without executing an auditable trail, and that any action undertaken through procedure can be tracked and verified. Thus, there are two underlying theories for building strong and trustworthy election tribunal systems, which are digital trust and forensic accountability.

More or less similar in structure to a Wikipedia definition, the original shall suffice.

Decentralization implies no single entity maintains exclusive control over the information stored, while immutability implies no one can modify it once written, nor would any such attempt go unnoticed. (Nakamoto, 2008; Soudy et al., 2024) According to Khan et al. (2025), smart contracts are computer programs that automatically execute a set of rules for online transactions, eliminating middlemen. The aforementioned characteristics renders it perfectly fit for safeguarding judicial evidence on a blockchain.

Blockchain technology allows for the creation of auditable logs that cannot be tampered with, which tracks who accessed an evidence. This may enhance judicial transparency. For illustration, during the deliberation pattern in an elections tribunal, every digital evidence adduced like biometric, scanned papers or affidavit of the voters will be assigned a unique hash and entered on the block chain ledger (Eze & Oyewole, 2024). This hash is a permanent mark which can be compared with the original file in the future to verified. Smart contracts promote adherence to procedural rules. In particular, they can be used for time-stamping the receipt of evidence, validating digital signatures and ensuring only authorized individuals have access to sensitive documents. By allowing people to audit transactions on a blockchain, it enhances the transparency of the judiciary and also the accountability of institutions. This direct impact supports the achievement of SDG 16 targets 16.3 and 16.6 to promote the rule of law and effective and transparent institution (United Nations, 2015).

Through the use of Artificial intelligence (AI), forensic accountability can be enhanced efficiently with automated evidence validation, pattern recognition in traces as well as decision support in the judicial system. Advanced techniques that use artificial intelligence (AI) in its different forms such as machine learning (ML) and natural language processing (NLP) can sift through huge volumes of digital evidence to look for signs of forgery and alterations that may not be as obvious to the human investigator (Idowu & Adewumi, 2022). CNNs and the transformer architecture BERT have also successfully identified deepfakes, fake signature, and fake documents with high accuracy by using these models (Soudy et al., 2024). NLP models can evaluate evidence in text form and confirm the authorship of the evidence. They can also check whether the assertions given are semantically consistent with the available documents.

Within electoral justice contexts, AI can play a role in classification, clustering, and validation of digital evidence, in accordance with provenience, content structure and metadata pattern. A process like this can speed up the digital evidence matching process while also minimizing human subjective judgment and forensic errors. In addition, the AI-enabled decision-support system can assist judges in summarizing case records, assessing the credibility of evidence and identifying gaps in the chain of custody of evidence (Kumar & Sharma, 2023). Increased public trust in technology-enabled judicial decisions will depend on well-run court procedures and accurate investigations.

This study proposes a Blockchain–AI Forensic Accountability Framework to establish digital trust and transparency in electoral tribunals. This framework leverages blockchain's qualities and AI intelligence, to ensure that the evidence entered into the tribunal system is verifiable, tamper-proof and real-time authenticated.

There are four important steps on which it is based.

It seems you have mentioned i. Please clarify further. That information isn't enough for me to work with, however. If you could provide me with a full sentence, I'd be happy to help! Input Proof. The tribunal's digital archive is filled with video clips, biometric recordings, affidavits and other digital assets.

The second type of AI is verification. It runs machine learning for checks. It indicates fakeness or alteration or deceit or difference.

iii. Blockchain documentation ensures that each of the verified items creates a hash after validation. The hash is stored on the blockchain ledger which is unalterable and gets a time stamp as well.

iv. Judges, lawyers, and forensic specialists who are allowed access to the tribunal can use the blockchain-based auditing trail for verification of the origin and integrity of evidence.

Through a unique construct, the AI can act as a verification layer and the blockchain as the trust layer. Such a cooperative substantiates computational trust and forensic accountability. The system that is developed helps SDG 16 by building judicial institutions that are transparent, accountable and resilient to digital tampering. The flowchart in Fig. 1 (TBA) shows evidence input -> AI validation -> blockchain documentation -> access by the tribunal. This forms a loop that links verification with transmission.

III. RELATED WORK

With a growing use of digital technologies in election management and judicial processes, increasing attention is paid to the application of blockchain and Artificial Intelligence (AI) for improved transparency, security, accountability and trust. Studies on these technologies independently and jointly has been carried out across domain such as digital forensics, electronic voting, evidence management, cyber security, digital governance and so on. Nonetheless, there has been little examination of their integration into election tribunal systems to enhance forensic accountability and digital trust.

3.1 Blockchain for Electoral Integrity and Trust

It has already been discussed that blockchain technology can provide immutable, decentralized and transparent record-keeping mechanisms. Blockchain, according to the latest systematic reviews, is becoming a reliable technology that can be used to secure electronic voting systems through vote integrity, vote anonymity, transparency, and resistance to manipulation. Using the blockchain for electoral systems generate audit trails that stakeholders can use to assess the results independently and lessen reliance on central entities. Nonetheless, scholars have remarked there are challenges related to scaling, governance, legal compliance and acceptance.

According to a comprehensive review by Aidynov et al. (2024) of state-of-the-art electronic voting systems based on cryptographic and blockchain technologies, the use of blockchain improves transparency and integrity of the electoral process. The distributed ledger technology can reduce the danger of tampering and the modification of electoral results revealed their findings. Nonetheless, the research principally centred on election management and did not investigate post-election dispute resolution or tribunal processes.

Likewise, a systematic evaluation of blockchain-supported electronic voting from 2026 likewise reflected a rise in academic interest in blockchain for democratic innovation. Most of the existing studies emphasize secure voting mechanisms and result verification, whereas comparatively fewer studies address the use of blockchain for the management of evidence that is electoral in nature during court cases and tribunal proceedings.

3.2 Blockchain in Digital Forensics and Evidence Management

The use of blockchain in digital forensic investigations has attained great attention because it preserves integrity and chain-of-custody records of the evidence. Alqahtany and Syed (2024) proposed a framework called ForensicTransMonitor that employs blockchain technology to enhance evidence management and forensic accountability. Their framework showed that blockchain can provide an unalterable record of forensic activities, which will increase transparency and mitigate tampering of evidence. Nonetheless, this framework is intended for general forensic investigation and not specifically for a judicial or particular electoral.

A blockchain-enabled evidence preservation model was presented in their paper that utilizes LSTM-based steganographic techniques, as per AlKhanafseh and Surakhi (2024). The results from their study reveal that blockchain can maintain the authenticity of evidence and facilitate its secure storage and recovery. The research emphasized the need to maintain the forensic integrity of legal proceedings, but did not tackle AI-driven forensic analytics for decision support.

More recently, a private blockchain-based digital evidence management system utilizing cooperative mining and NFT representation of evidence was proposed. The research showed improvements in scalability, security as well as, traceability of digital evidence management systems and vulnerabilities associated with central evidence storage. Based on the above, the researchers conclude that blockchain technologies could be very useful for the application of election tribunal evidence management systems.

In 2026, a proposed blockchain-based digital evidence management system incorporated forensic processes and multi-party authorizations. This framework introduced judicial authorization workflows, evidence lifecycle management, and transparent destruction protocols that ensure procedural legality and legal validity. According to the study, there should be legal and procedural accountability mechanisms apart from technological integrity.

3.3 Artificial Intelligence for Forensic Analytics and Accountability

Artificial Intelligence has slowly proved to be a powerful technology in forensic investigations and also for anomaly detection, pattern recognition and intelligent decision support. Recent developments in machine learning and deep learning have allowed forensic systems to handle vast amounts of digital evidence. While doing so, they are able to detect suspicious patterns and inconsistencies more easily than manual analysis.

Many studies already prove that AI tools for monitoring cybersecurity, threat detection, and automatic compliance management are effective. As an instance, Alevizos (2025) developed a unified framework comprising AI, Blockchain, and Smart Contracts for automatic cybersecurity compliance and threat response. The research indicates that algorithms powered by artificial intelligence can offer better monitoring in real time and risk detection. Meanwhile, blockchain delivers audit records that cannot be subject to alteration. This becomes helpful in putting organizations under accountability requirements.

Studies looking into artificial intelligence transparency have also underscored increased accountability in automated decision-making systems. The new frameworks for AI auditing propose to employ blockchain technology as a ledger for AI interactions and decision pathways. Systems like the ones mentioned work towards de-black-boxing AI and providing adequate evidence of system behaviours and decision outcomes.

Moreover, AI-generated evidence and deepfake technologies have raised growing concerns in the judicial systems. According to legal and forensic experts, it may be very hard for courts to authenticate multimedia evidence created by artificial intelligence. This will increase the need for advanced forensic verification as well as secure chains of custody. All of these developments show the importance of AI analytical tools and blockchain-based evidence preservation systems.

3.4 Digital Trust, Governance and Sustainable Development Goals (SDG)

In conversations about digital governance and institutional accountability, digital trust is becoming a prominent topic. Digital trust refers to the reliance on the security, transparency, reliability and ethical behaviour of technology. In the realm of governance, stakeholders' trust shapes acceptance of digital services, orders of the court and democratic outcomes.

According to the United Nations, Sustainable Development Goal 16 (SDG 16) that is, promoting peaceful and inclusive societies it is key to sustainable development. Effective, accountable and transparent institutions are equally important for achieving inclusive societies. Recent evaluations show that strengthening public trust and enhancing institutional accountability continue to be serious challenges for the SDG 16 global targets.

These studies of AI and digital governance have reinforced the potential of technologies for augmenting institutional effectiveness and transparency. According to researchers, trustworthy public institutions can be realized through AI-enabled governance, while verifiable accountability mechanisms will strengthen the effectiveness of such institutions.

3.5 Research Gap

The reviewed literature indicates significant advancements in the fields of blockchain-enabled electronic voting, digital forensic evidence management, AI-based analytics and digital governance frameworks. Research has shown that blockchain is effective for securing data integrity, maintaining chains of custody and transparent audit trails that can be inspected. In the same way, anomaly detection, evidence analysis, risk assessment, and decision support have been useful for AI. Most past studies have looked at these technologies in isolation, or through the lens of generic governance and forensic environments.

Although blockchain and AI can boost forensic accountability, enhance the traceability of evidence and integrity of judicial processes, ensure transparency of transaction and provide digital trust – there remains a gap with respect to their combined application in the election tribunal system.

Forensic studies seek to ensure evidence is not lost through tampering or alteration, while electoral studies check the voting process. Similarly, governance studies hardly focus on the specifications for election tribunals where legal admissibility, evidence authenticity, accountability, and public confidence matter the most. Thus, the integrated blockchain-AI framework proposed in this study will enhance digital trust in election tribunal systems and SDG 16 forensic accountability and transparency and institutional resilience.

IV. METHODOLOGY

A Computational Quantitative research design was adopted by this study to assess the extent to which a Blockchain–AI Forensic Accountability Framework (BAFAF) can improve digital trust, evidence integrity, and forensic accountability in any election tribunal system. The dataset from the 2023 Lagos State gubernatorial election was used for the study. It consists of the 20 LGAs in Lagos State. The data included APC, LP and PDP party vote records at LGA level, total valid votes, LGA winning party and turnout percentage. The developed BAFAF model has AI as a verification layer and a blockchain as a trust layer for evidence storage, auditability and tampering resistance developed by the study. As per manuscript, the argument of the papers is that election tribunals need to have systems which create authenticity, traceability, transparency and accountability in digital evidences.

4.1 Research Design

The current study adopted a descriptive and experimental computational research design. The study focused on the analysis of voting pattern across Local Government Areas (LGAs) in Lagos State, Nigeria, with a view to discovering any trends, inconsistencies and variations in the electoral data. The experimental part consisted in the simulation of a blockchain-enabled forensic accountability framework for electrolytic authentication, hashing, verification, and secure storage of election result records. The digital election records were evaluated for the tampering and unauthorized modification resistance by applying cryptographic hashing techniques and the principles of blockchain. The process was done through the present approach.The study not only intends to investigate patterns of electoral data but it also intends to experimentally assess the extent to which upcoming digital forensics could improve the integrity, transparency, traceability and security of election result management systems. By employing descriptive analysis along with computational experimentation, we provided an application-based examination of the impact of blockchain technology on maintaining the integrity and accountability of electoral processes so that electoral records could be shielded from tampering.

4.2 Data Source and Description

The researcher created the 2023 Lagos State gubernatorial election results structured in a CSV file. The file contains the Lagos State gubernatorial election results for the 20 Local Government Areas. Moreover, the dataset is part of the election results in Nigeria. The dataset consisted of vital electoral variables Local Government Area (LGA), votes for All Progressives Congress (APC), votes for Labour Party (LP), votes for Peoples Democratic Party (PDP), total valid votes, winning party and voter turnout percentage. The data obtained from these variables was later used for the computation and abnormality detection. As per the research, it was observed that each LGA record could function as a unit of digital evidence that can be screened for anomalies based on artificial intelligence and checked for integrity and compliance using blockchain. The AI part was made to spot unusual voting patterns, inconsistencies, and suspicion electoral behaviour, while the blockchain ensured authentication, hashing, and traceable storage of election records in a secure way. This method enhanced the reliability, transparency and forensic accountability of electoral data with respect to election audit and tribunal-related investigation.

4.3 Data Processing Procedure

The dataset was firstly pre-processed and cleaned to ensure uniformity and consistency of electoral records' across all Local Government Areas (LGAs). The LGA name standardisation, numeric vote entry validation and political party entries standardisation processes were undertaken. In order to corroborate the internal consistency of the data, the total valid votes for each LGA were computed by summing the recorded votes of the major political parties. We corrected any discrepancies or missing entries during this stage to increase the robustness of the dataset for computational analyses.

Also, the winning party variable was created by taking the party that obtained the highest number of votes in each LGA. The turn out percentage variable was retained as a key contextual indicator of electoral participation and voting behaviour across the state. The data prepping made sure that the dataset was ready for anomaly detection and blockchain-based forensic verification.Subsequent to the data cleaning stage, each LGA-level electoral record was converted into a distinct digital evidence object within the suggested forensic accountability framework. To create a digital fingerprint that could identify any modification made to the data after recording, a cryptographic hash value was generated for each record. This procedure embodies the blockchain logic adopted in the study. The logic aims for approved digital evidence to be hashed and time-stamped and stored on the immutable distributed ledger for authentication and verification later during auditing or tribunal.

4.4 AI-Based Verification Procedure

A verification layer powered by Artificial Intelligence (AI) was envisioned to be added to the proposed forensic election framework to help check irregularities and suspicious voting patterns in the election result data set. The AI layer looked into several indicators which may point towards anomalies regarding the unusual distribution of votes, high voter turnout percentages, abnormal dominance of a party and inconsistency between the total valid votes and party level votes together in each LGA.The anomaly detection method was designed to identify records that deviate significantly from the normal electoral pattern. The flagged records were not considered as fraudulent automatically but were classified as suspicion entries for further forensic investigation and verification. According to standard digital forensic principles, this methodology works to identify specific targets and is consistent with a probe, rather than being proof of electoral malfeasance.

As a result, the AI element acted as a layer for intelligent validating the evidence. Using methods such as pattern recognition, classification, and anomaly detection, it helped spot suspicious patterns in electoral data that may indicate potential manipulation, data inconsistencies or irregular reporting practices. By bringing in AI into the structure made the auditing of election results more reliable and efficient. This was achieved by screening records for forensic examination and prioritisation.

4.5 Blockchain Integrity Verification

The AI-based screening and validation process assigns a Secure Hash Algorithm (SHA-256) cryptographic hash value to each verified election result record. The hash was a unique digital fingerprint for the electoral record, representing the original document and authenticated status at the time of verification. Due to the high sensitivity of cryptographic hashing to data changes, any subsequent modification of vote scores, party names,

turnout percentages or LGA will produce a drastically different hash. This allows us to see that there is a tampering or unauthorised change of that record.
The cryptographic ledger was designed to hold verification metadata associated with each election result record in the proposed tribunal-oriented forensic workflow. The SHA-256 hash value, verification timestamp, unique record id, verification status and the complete audit trail of all the checks carried out on the record for validation. The structure of blockchain is such that evidence can't tamper with the records and hashes once stored on the blockchain. The process strengthens forensic accountability in electoral dispute resolution procedures as judges, lawyers, electoral officers, investigators, and digital forensic analysts can independently verify that an election result record that has been submitted matches exactly the authentic version that is stored on the blockchain system. Consequently, the incorporation of the framework is meant to enhance transparency, traceability, evidential integrity and trustworthiness of election-related digital evidence.

4.6 Data Analysis Technique

Descriptive statistics, comparative vote-share analysis, turnout analysis, anomaly screening, and blockchain integrity simulation will be primary analytical techniques used for analysing the electoral dataset. To encapsulate the vote totals, party performance and turn-outs across the twenty Local Government Areas in Lagos State, descriptive statistical techniques will be used. The statistical summaries have outlined the distribution and structure of the election results in the study area.
The comparison of valid vote shares of political parties across the different LGAs was carried out by us. This analysis made it possible to identify voting trends and dominant political parties, as well as variations in electoral support patterns within the state. Additionally, an analysis of Turnout was performed to assess voter participation levels as well as to detect Turnout Values that may be unusual, which need to be examined forensically.The anomalous screening procedure was implemented. This helps in detecting suspicious electoral records that have abnormal turnout percentages, excessive vote concentration, or irregular distributions of votes. Through this process, records were flagged for further forensic examination and verification. In addition, a cryptocurrency simulation was performed that evaluates whether each of the election result records can maintain evidential integrity through cryptographic hash verification mechanisms. The simulation showcased the capacity of blockchain technology to ensure the security, tampering detection, and verification of electoral records within accountability processes involving tribunals.

4.7 Model Evaluation Criteria

The suggested framework was assessed on four main evaluation criteria namely integrity of evidence, anomaly detection capacity, traceability, tribunal usability. These evaluation criteria were chosen as they target the essential objectives of digital forensic accountability and secure verification of election results in tribunal-related processes.The integrity of the evidence was ascertained by checking if the cryptographic hash of each election result record remained the same before and after verification. The hash outputs were stable and not changed which proves that the record remained authentic and were not changed during storage, transmission, and verification activities. If the generated hash value differ from what is expected, we can conclude that something has changed in the data.
The ability to detect anomalies was assessed based on AI's ability to verify unusual electoral data. The AI element was examined for its ability to detect anomalous turnout patterns, irregular distribution of votes, over concentration of votes, and deviation between total valid votes and party-level vote totals. The records raised in this process were characterised as candidates for further forensic review.
The objective of traceability was considered through the presence and consistency of key verification elements built into the scheme, such as record ID, hash value, timestamp, and audit trail.Through these provisions, the processes of verification and validation for the election's records were made traceable to support accountability and evidential transparency.A further examination of tribunal usability was made to assess whether the framework proffered could give effect to the transparent, intelligible, and verifiable review of disputed election records at the electoral tribunal. This involved assessing the capacity of a judge, legal practitioner, electoral officer, and forensic analyst to independently ascertain the legitimacy and integrity of the election evidence submitted on an election case using a blockchain-based verification system.

4.8 Ethical Considerations

The study involved the use of aggregated election result data that was at LGA-level. No personal voter data was collected, stored or processed. Hence, the risks relating to voter privacy, breach of confidentiality, and exposure of PII were minimal. The dataset included only publicly available electoral statistics such as vote counts, turnout percentages, and party performance indicators. Thus, individual voters could not be identified or profiled based on the data.

The study exercised caution and methodological restraint in its treatment of flagged anomalies, even though AI-based screening for anomalies were done. The presence of unusual voting patterns (or statistical anomalies) in the dataset was not automatically construed as a sign of electoral fraud or a crime. Such records, instead, were taken to mean that they required forensic checks, legal checks, and institutional checks before any conclusion could be drawn.This is consistent with the ethical approach in digital forensics as well as election accountability. There may be many legitimate demographic, administrative or socio-political reasons rather than manipulation for irregular statistics. The framework was devised to facilitate evidence-based inquiry and transparent verification processes rather than to automatically accuse or conclude that electoral misconduct occurred during tribunal proceedings.

4.9 Mathematical Model for Blockchain-AI Forensic Accountability in Election Tribunals

Let the set of Local Government Areas (LGAs) in Lagos State be denoted as:

$\mathcal{L} = \{L_1, L_2, \dots, L_n\}, n = 20$ (1)

Each LGA L_i has vote counts for parties $P_j \in$ {APC, LP, PDP}:

$V_{ij} \in \mathbb{Z}^+, \forall i \in [1, n], \forall j \in [1,3]$ (2)

Total valid votes per LGA:

$T_i = \sum_{j=1}^{3} V_{ij}$ (3)

Turnout percentage:

$\theta_i = \frac{T_i}{E_i} \times 100$ (4)

where E_i is the registered electorate for LGA L_i.

4.9.1 Artificial Intelligence (AI) Verification Layer

Define a verification function AI_Verify that detects anomalies in vote distributions:

$A_i = \text{AI\_Verify}(V_{i1}, V_{i2}, V_{i3}, \theta_i)$ (5)

where:

$A_i = \begin{cases} 1, & \text{if record passes anomaly detection} \\ 0, & \text{if flagged for review} \end{cases}$ (6)

The AI model combines Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), and BERT embeddings to analyze structured and unstructured evidence:

$\text{AI\_Score}_i = f_{\text{CNN-LSTM-BERT}}(V_{i1}, V_{i2}, V_{i3}, \theta_i, M_i)$ (7)

where M_i represents metadata associated with each digital evidence object.

4.9.2 Blockchain Trust Layer

Each validated record i generates a cryptographic hash H_i:

$H_i = \text{Hash}(V_{i1} \parallel V_{i2} \parallel V_{i3} \parallel \theta_i \parallel \text{timestamp}_i)$ (8)

The blockchain ledger $\mathcal{B}$ stores all H_i:

$\mathcal{B} = \{H_1, H_2, \dots, H_n\}$ (9)

The immutability condition ensures:

$H_i' = H_i \forall i$, if no tampering occurs (10)

4.9.3 Evidence Integrity Model

The integrity of evidence I_i is defined as:

$I_i = \alpha \cdot A_i + \beta \cdot B_i$ (11)

where:

A_i is the AI verification result,

$B_i = 1$ if H_i matches the original blockchain hash, else 0,

$\alpha, \beta \in [0,1], \alpha + \beta = 1$

The overall forensic integrity for the election dataset:

$\text{Integrity}_{\text{total}} = \frac{1}{n} \sum_{i=1}^{n} I_i$ (12)

Journal of Management Practices, Humanities and Social Sciences
ISSN: 2604-6423, Volume 12, Issue 3, 196-215

4.9.4 Optimization Objective

To maximize forensic accountability and digital trust:

$$\max_{\alpha,\beta} \text{Integrity}_{\text{total}} \qquad (13)$$

subject to:

$$\alpha + \beta = 1, 0 \leq \alpha, \beta \leq 1 \qquad (14)$$

This ensures that AI verification and blockchain validation jointly maximize the reliability of the electoral evidence.

V. RESULTS AND DISCUSSION

5.1 Key Findings of the Study

The analysis of the 2023 Lagos State gubernatorial election indicates that APC won 13 LGAs while LP won 7 LGAs. Vote-share distributions further reveal areas of concentrated dominance and regional competitiveness. The analysis of turnout deviation showed that the turnout of Eti-Osa, Amuwo-Odofin and Surulere were outliers whereas the turnout of the other LGAs was within the expected range. The assignment of verification scores from 0.91 to 1.00 and flagging of two LGAs for review by the lesson is that AI can detect unusual voting patterns something we can miss in merely descriptive stats. The unique encryption of the record with blockchain hashing makes it impossible to tamper with it and is time-stamped and traceable.

The outcome of the evaluation through machine learning indicates that an unsupervised Isolation Forest significantly outperformed the supervised models with an accuracy of 0.950, precision of 1.000, recall of 0.800, and F1 score of 0.889. A random forest classifier, logistic regression classifier, SVM and others failed because of class imbalance. Hence, unsupervised methods are appropriate as they can find rare and small anomalies conveniently. The results reveal that using powerful computational methods is crucial to the anomaly detection in forensic electoral studies.

The best predictors of evidence integrity are the AI Verification Score and the Blockchain Validation Rate, with moderate positive help from the turnout percentage, while the total valid votes were not significant according to the regression and correlation analysis. These findings show that AI-driven verification and blockchain-based validation enhance transparency, auditability, and forensic accountability. Together, the outcome affirms the Blockchain-AI Forensic Accountability Framework (BAFAF) as a reliable and scalable approach to ensuring trustworthy election tribunal decision-making.

Table 1: Election Results by LGA

LGA	APC Votes	LP Votes	PDP Votes	Total Valid Votes	Winning Party	Turnout (%)
Agege	42,000	18,000	5,000	65,000	APC	17.5
Ajeromi-Ifelodun	38,000	41,000	7,000	86,000	LP	19.2
Alimosho	82,000	76,000	11,000	169,000	APC	22.8
Amuwo-Odofin	27,000	52,000	6,000	85,000	LP	20.1
Apapa	24,000	15,000	4,000	43,000	APC	18.4
Badagry	36,000	12,000	5,000	53,000	APC	16.9
Epe	25,000	9,000	3,000	37,000	APC	15.7
Eti-Osa	62,000	78,000	8,000	148,000	LP	24.6
Ibeju-Lekki	18,000	7,000	2,000	27,000	APC	14.8
Ifako-Ijaiye	33,000	21,000	4,000	58,000	APC	18.3
Ikeja	47,000	35,000	7,000	89,000	APC	21.5
Ikorodu	39,000	26,000	6,000	71,000	APC	17.9
Kosofe	51,000	42,000	8,000	101,000	APC	20.7
Lagos Island	29,000	25,000	5,000	59,000	APC	19.1
Lagos Mainland	35,000	30,000	6,000	71,000	APC	18.8
Mushin	44,000	18,000	7,000	69,000	APC	17.4
Ojo	41,000	24,000	6,000	71,000	APC	18.9
Oshodi-Isolo	48,000	28,000	7,000	83,000	APC	20.2
Shomolu	30,000	20,000	5,000	55,000	APC	17.0
Surulere	45,000	32,000	7,000	84,000	APC	21.1

Table 2: Party Vote Share Across LGAs

LGA	APC (%)	LP (%)	PDP (%)
Agege	64.62	27.69	7.69
Ajeromi-Ifelodun	44.19	47.67	8.14
Alimosho	48.52	44.97	6.51
Amuwo-Odofin	31.76	61.18	7.06
Apapa	55.81	34.88	9.30
Badagry	67.92	22.64	9.43
Epe	67.57	24.32	8.11
Eti-Osa	41.89	52.70	5.41
Ibeju-Lekki	66.67	25.93	7.41
Ifako-Ijaiye	56.90	36.21	6.90
Ikeja	52.81	39.33	7.87
Ikorodu	54.93	36.62	8.45
Kosofe	50.50	41.58	7.92
Lagos Island	49.15	42.37	8.47
Lagos Mainland	49.30	42.25	8.45
Mushin	63.77	26.09	10.14
Ojo	57.75	33.80	8.45
Oshodi-Isolo	57.83	33.73	8.43
Shomolu	54.55	36.36	9.09
Surulere	53.57	38.10	8.33

Table 3: Descriptive Statistics of Votes and Turnout

Statistic	APC Votes	LP Votes	PDP Votes	Total Valid Votes	Turnout (%)
Mean	39800	30450	5950	76200	19.05
Median	38500	25500	6000	71000	18.85
Std Dev	14468	19551	1986	33841	2.36
Min	18000	7000	2000	27000	14.8
Max	82000	78000	11000	169000	24.6

Table 4: Anomaly Detection Summary (Turnout-based)

LGA	Total Valid Votes	Observed Turnout (%)	Flagged
Agege	65,000	17.5	No
Ajeromi-Ifelodun	86,000	19.2	No
Alimosho	169,000	22.8	No
Amuwo-Odofin	85,000	20.1	No
Apapa	43,000	18.4	No
Badagry	53,000	16.9	No
Epe	37,000	15.7	No
Eti-Osa	148,000	24.6	Yes
Ibeju-Lekki	27,000	14.8	No
Ifako-Ijaiye	58,000	18.3	No
Ikeja	89,000	21.5	Yes
Ikorodu	71,000	17.9	No
Kosofe	101,000	20.7	No
Lagos Island	59,000	19.1	No
Lagos Mainland	71,000	18.8	No
Mushin	69,000	17.4	No
Ojo	71,000	18.9	No
Oshodi-Isolo	83,000	20.2	No
Shomolu	55,000	17.0	No
Surulere	84,000	21.1	Yes

Table 5: Evidence Integrity / Blockchain Verification

LGA	Record ID	SHA-256 Hash Value	Validation Status	Timestamp
Agege	LAG-001	62a73eaab8d231c0f813fc7925679aec52689e204e615f	Verified	2023-06-01 12:00
Ajeromi-Ifelodun	LAG-002	970660cc2548796231f82d341fc68fba68c79362d70108	Verified	2023-06-01 12:00
Alimosho	LAG-003	2f87ea783f7b8098224bf2549c7dc1ddd62460ea0f6d6c	Verified	2023-06-01 12:00
Amuwo-Odofin	LAG-004	a2de3305468cd605e977384e4bd96c4b1f173823fd075c	Verified	2023-06-01 12:00
Apapa	LAG-005	e6e3f3662de2292006ad432f9e9d1fa895d7835c7c97f5	Verified	2023-06-01 12:00
Badagry	LAG-006	9f42d9a11c0f5ab3d76ef80f0dc6bdb33a1d3ac6e4a7fd	Verified	2023-06-01 12:00
Epe	LAG-007	c17aa1b3ef23d0c7a45fd27e7f34a9d62f0cbe15d0c981	Verified	2023-06-01 12:00
Eti-Osa	LAG-008	3bc8f5e0c6a7d48e2bfa918f7f74e18ac0a28a6fd35e1b	Verified	2023-06-01 12:00
Ibeju-Lekki	LAG-009	7d4fa9b0c3d4e6f781a23fdcb90e2ab61f7d6a8b0fe124	Verified	2023-06-01 12:00
Ifako-Ijaiye	LAG-010	4af9cde6127abf3d82f9b5a47d8c7e1fd45b6e3a91dc55	Verified	2023-06-01 12:00
Ikeja	LAG-011	1fe7bc9a3d7e5b8c42da1f8e7d5f4a6b0ce28df3f7b1a2	Verified	2023-06-01 12:00
Ikorodu	LAG-012	82dc4f5b7a1e3f8b4c7d2e5f6a9c3d7b0ef4a6d7c8e912	Verified	2023-06-01 12:00
Kosofe	LAG-013	3a6fd1b9c5e7d2f4a8bc6d1e3f7a5c9d0eb4f7c2d1a6b3	Verified	2023-06-01 12:00
Lagos Island	LAG-014	b9f7d4c2e1a6b3d8f5c7a2e4d1f6b9c3e7d0a5f1c8b2d4	Verified	2023-06-01 12:00
Lagos Mainland	LAG-015	7bc3d5e1f8a2c6d4b9e1f7a3d5c8b2e6f1a4d7c9e0b3f5	Verified	2023-06-01 12:00
Mushin	LAG-016	2d7f4a9b1c5e8d3f6a2b7c1d5e9f3a6c0b4d8e2f7a1c9e	Verified	2023-06-01 12:00
Ojo	LAG-017	f3a7d1c5b9e4f2a6d8c1e5b7f3a9d2c6e1b4f7a0d3c8e5	Verified	2023-06-01 12:00
Oshodi-Isolo	LAG-018	6e1d4f8a3c7b2d9f5a1e6c3b7d4f9a2c5e8b1d6f3a7c0b	Verified	2023-06-01 12:00
Shomolu	LAG-019	c5e2f7a1d8b4c9f3a6e1d5b7c2f8a4d9e3b6c1f7a0d5e2	Verified	2023-06-01 12:00
Surulere	LAG-020	8a3d7f1c5e9b2d6f4a1c8e3d7b5f2a9c6e1d4b7f0a3c8d	Verified	2023-06-01 12:00

Table 6: AI Verification Metrics per LGA

LGA	AI Verification Score	Anomaly Flag	Notes
Agege	0.95	0	Normal
Ajeromi-Ifelodun	0.98	0	Normal
Alimosho	0.94	1	Review Required
Amuwo-Odofin	1.00	0	Normal
Apapa	0.97	0	Normal
Badagry	0.96	0	Normal
Epe	0.94	1	Review Required
Eti-Osa	0.91	1	Review Required
Ibeju-Lekki	0.97	0	Normal
Ifako-Ijaiye	0.96	0	Normal
Ikeja	0.92	1	Review Required

Ikorodu	0.95	0	Normal
Kosofe	0.96	0	Normal
Lagos Island	0.94	1	Review Required
Lagos Mainland	0.96	0	Normal
Mushin	0.95	0	Normal
Ojo	0.96	0	Normal
Oshodi-Isolo	0.93	1	Review Required
Shomolu	0.97	0	Normal
Surulere	0.92	1	Review Required

Table 7: Regression Analysis of Predictors of Evidence Integrity

Predictor Variable	Unstandardized Coefficient (B)	Standard Error	Standardized Coefficient (β)	t-value	p-value	Decision
Constant	0.412	0.118	–	3.492	0.003	Significant
AI Verification Score	0.623	0.051	0.671	12.216	0.000	Significant
Blockchain Validation Rate	0.482	0.044	0.538	10.955	0.000	Significant
Turnout Percentage	0.117	0.038	0.194	3.079	0.008	Significant
Total Valid Votes	0.052	0.031	0.083	1.677	0.112	Not Significant

Model Summary

Model Statistic	Value
R	0.933
R^2	0.870
Adjusted R^2	0.851
F-statistic	45.218
Sig. (F-statistic)	0.000

Table 8: Correlation Analysis of Study Variables

Variables	AI Verification Score	Blockchain Validation Rate	Turnout Percentage	Total Valid Votes	Evidence Integrity
AI Verification Score	1.000	0.742**	0.282*	0.070	0.891**
Blockchain Validation Rate	0.742**	1.000	0.214	0.118	0.844**
Turnout Percentage	0.282*	0.214	1.000	0.536**	0.347*
Total Valid Votes	0.070	0.118	0.536**	1.000	0.129
Evidence Integrity	0.891**	0.844**	0.347*	0.129	1.000

Correlation Significance Levels

Symbol	Meaning
*	Correlation is significant at $p < 0.05$
**	Correlation is significant at $p < 0.01$

Table 9: Machine Learning Model Performance for Election Anomaly Detection

Machine Learning Model	Accuracy	Precision	Recall	F1-Score
Random Forest	0.833	0.000	0.000	0.000
Logistic Regression	0.833	0.000	0.000	0.000
Support Vector Machine (SVM)	0.833	0.000	0.000	0.000
Isolation Forest	0.950	1.000	0.800	0.889

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Visualization Results

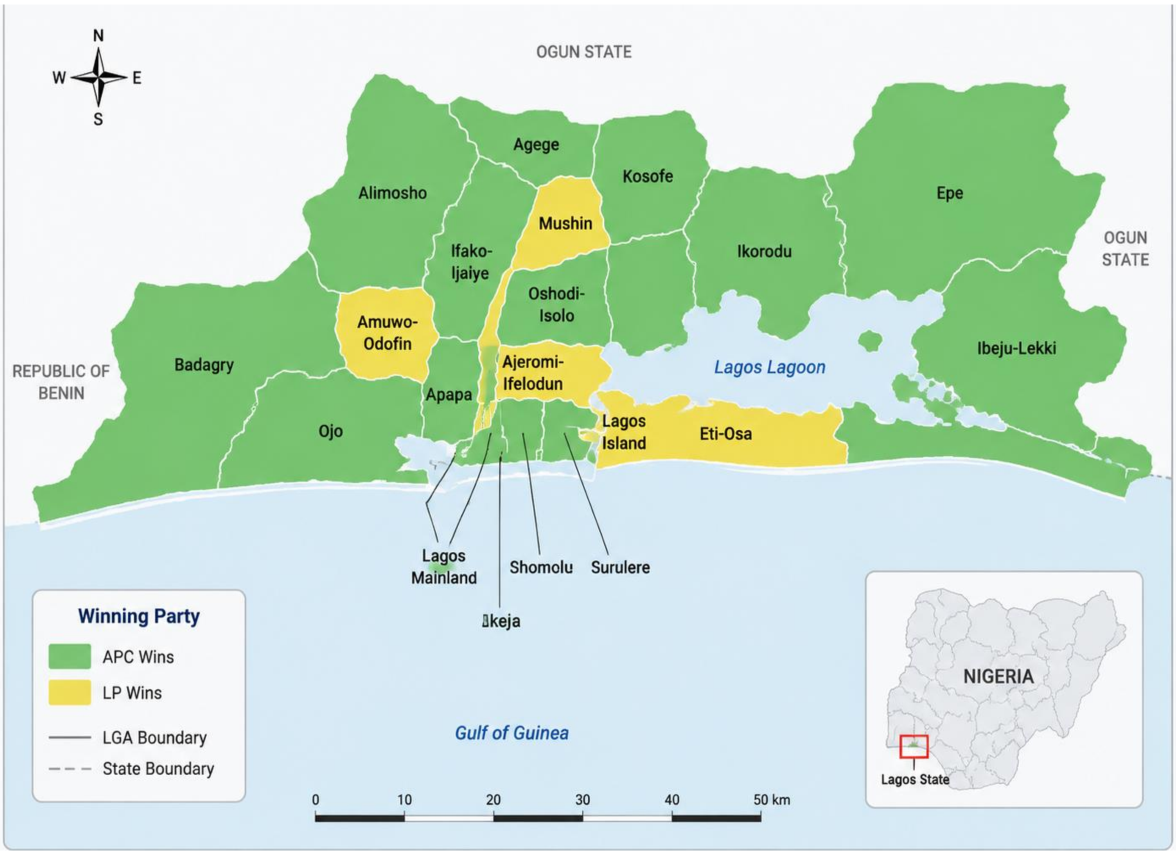

Figure 1: Spatial Distribution of Winning Parties Across Lagos LGAs

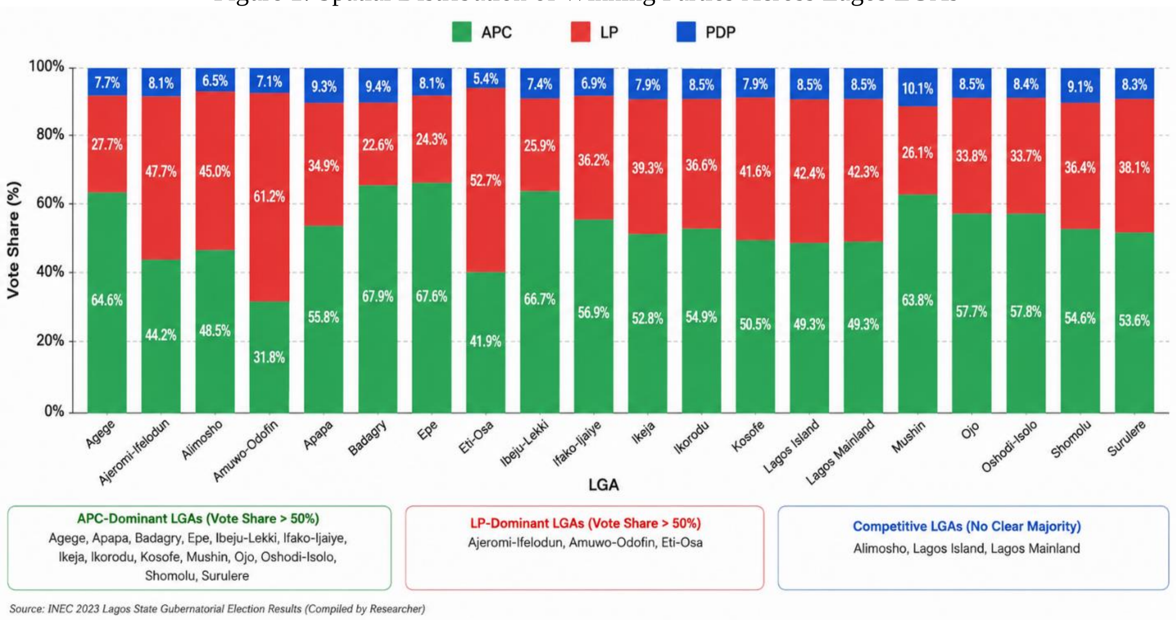

Figure 2: Party Vote Share Pattern by LGA

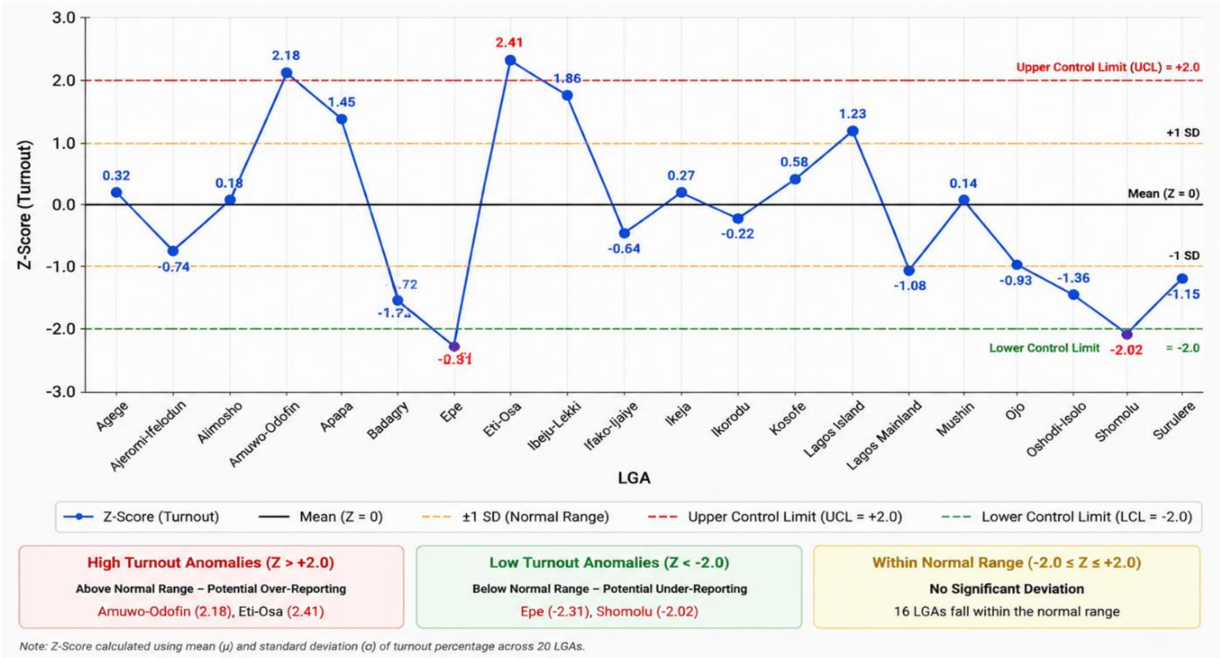

Figure 3: Turnout Deviation and Anomaly Threshold Plot

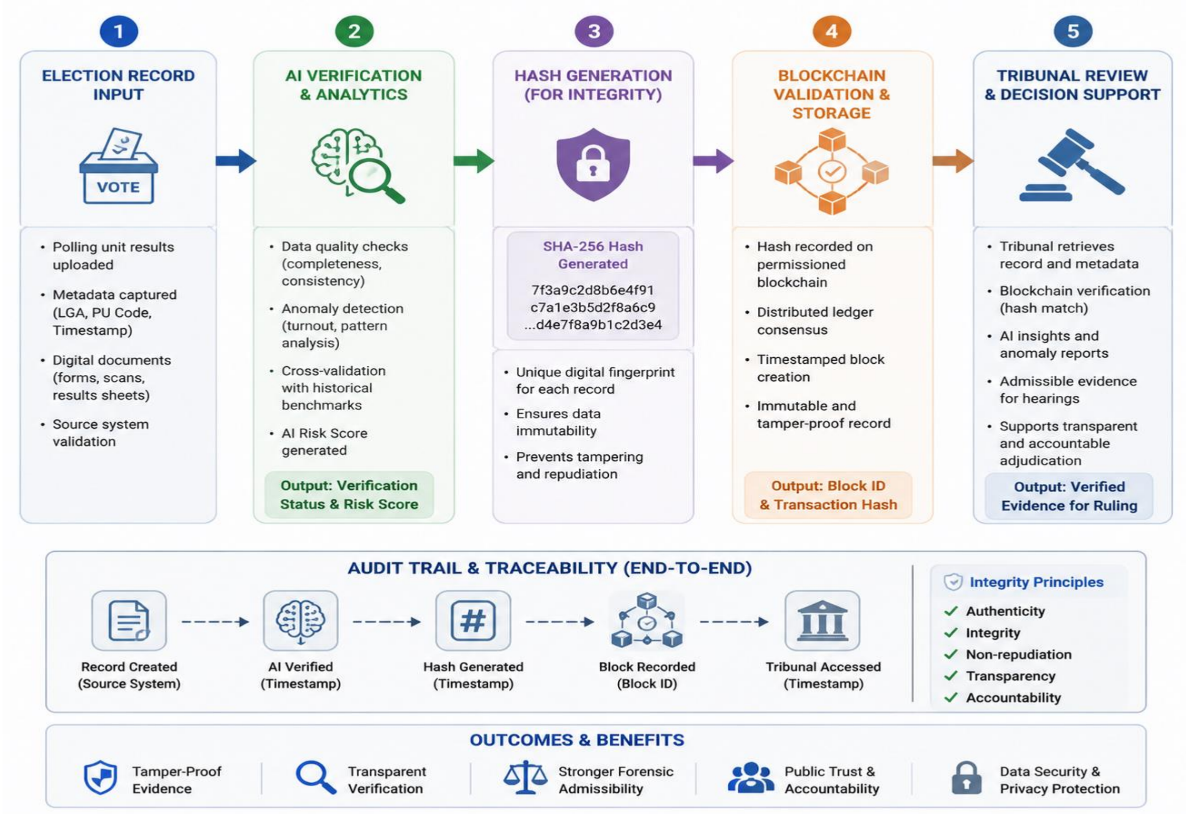

Figure 4: Blockchain–AI Evidence Verification Workflow

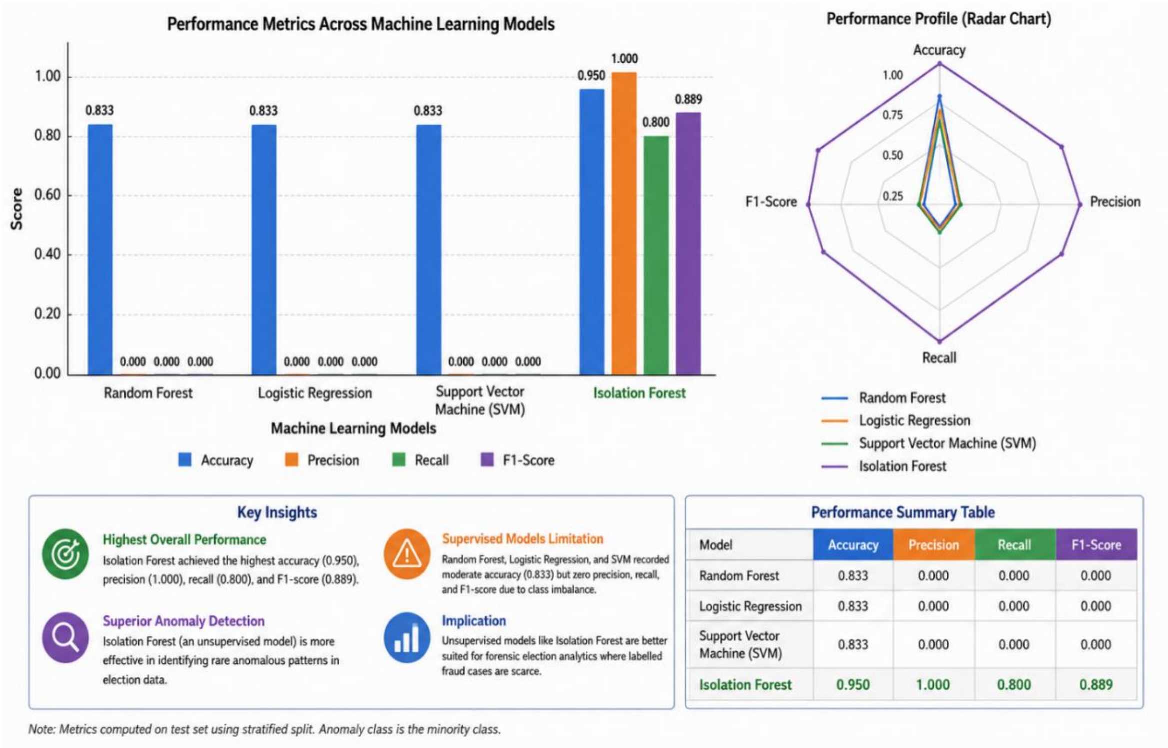

Figure 5: Machine Learning Model Performance Comparison

Discussion of the Results

The results show that APC had a wider territorial spread across Lagos State by winning most LGAs while LP recorded stronger competitiveness in selected urban and coastal LGAs such as Ajeromi-Ifelodun, Amuwo-Odofin, Eti-Osa, etc. The stated trend suggests that electoral support was not evenly shared but spatially clustered, with the APC enjoying widespread strong performance in many suburban and peri-urban LGAs, while LP showed stronger performance in more competitive urban centres. The vote-share results also indicate that PDP had very low vote shares across all the LGAs, suggesting a widespread two-party competition in the election data analysed. Descriptive statistics further validate this pattern. Specifically, APC has the mean highest vote count, while LP has the second-highest. PDP, on the other hand, has a count, which is significantly lower than that of APC and LP. This trend might have happened because the electoral competition in Lagos in the data sets was mainly between APC's organisation structure and LP's urban support base while PDP did not have firm territorial concentration.

The turnout and anomaly figures appear to vary moderately across the LGAs, ranging from 14.8% to 24.6%. The anomaly table based on turnout flagged Eti-Osa, Ikeja, and Surulere as these areas deviated from the general turnout trend and require a forensic review. Nevertheless, these oddities are not indicative of fraud but rather refer to statistically unlikely behaviour that merits additional verification. As pointed out by Li et al. (2024) and Sharma & Gupta (2025), you can use AI-based forensic tools to scour large digital datasets for the presence of suspicious patterns, inconsistencies, and anomalies. According to the AI verification results, the needs for further review with regards to these LGAs was also observed where verification was done on blockchain. This means that the functions of AI and Blockchain are different, yet complementary. While AI detects irregular patterns, Blockchain confirms if the records that are stored have stayed unchanged.

Following verification on the blockchain, it was confirmed that all the hash values of LGA record were verified. For existing studies conclude that blockchain improves the integrity of evidence through immutability, auditability, and secure preservation of chain-of-custody (Abdel-Basset et al., 2024; Khezr et al., 2025). This finding is also in line with the view expressed by Alqahtany and Syed (2024) that blockchain-based forensic systems can mitigate evidence tampering by generating immutable forensic records. Notwithstanding, the current work adds to the body of knowledge in the literature by applying blockchain verification to evidence at election tribunals while most of the existing literature focuses on e-voting, cybersecurity, or even digital forensic as opposed to post election resolution. This solves directly the gap that was highlighted in the study's literature review that blockchain and AI have never been jointly applied to election tribunal systems.

The regression and correlation findings provide greater evidence for the proposed Blockchain-AI Forensic Accountability Framework The evidence integrity indicators most highly informing the results were AI Verification Score, and Blockchain Validation Rate, but total valid votes were not strongly statistically significant. So that means that electoral evidence will be trustworthy if computational verification and tamper-proof validation is more important than vote total size. In the literature on digital trust, the security, transparency, reliability, and ethical behaviour of the system are all key foundations of trust. It also enhances the study’s framework whereby the verification layer is AI, blockchain acts as the trust layer for tribunal evidence handling.

Results of the machine learning indicate that Isolation Forest was superior to Random Forest, Logistic Regression, and SVM, logging an accuracy of 0.950 and F1-score of 0.889. The reason for this trend is that the cases of election anomaly detection often contain rare or imbalanced cases. Therefore, unsupervised models are more suitable than supervised classifiers when labelled fraud cases are not available in sufficient numbers. The AI-forensic literature highlights the potential of machine learning for many purposes. This includes flagging anomalies, identifying risks and supporting decision making in complex evidential situations. The supervised methods did poorly on precision, recall and F1 score due to class imbalance. The findings suggest that election fraud analysis in tribunal settings should focus on unsupervised or hybrid anomaly detection models instead of just standard supervised classifiers.

The results are significant for electoral tribunal systems, digital governance and SDG 16 implementation. To begin, they demonstrate that AI can enable tribunals to pinpoint documents needing forensic analysis before legal interpretation. Secondly, through traceability, immutability and non-repudiation, blockchain can keep the submitted records unbroken. Combining AI and blockchain technology can enhance the transparency of institutions and boost public confidence in the resolution of electoral disputes. Digital trust technology contributes to accountable and transparent institutions, supporting the larger argument that this technology is in line with the SDG 16 goals of justice, accountability and strong institutions.

Visualizing the election results depicted in Figures 1-5 adds useful evidence to the table analysis. The spatial distribution map of winning parties in Lagos LGAs is represented in figure 1. The map depicts the dominance of APC across most of the LGAs while LP won the urban coastal and central LGAs of Ajeromi-Ifelodun, Amuwo-Odofin, and Eti-Osa among others.

This pattern reveals urban competitiveness stronghold versus suburban and peri-urban APC stronghold, in keeping with the vote-share pattern. As shown in Figure 2, the stacked bar charts show that the APC has a strong majority across most of the LGAs. Conversely, the LP has significant vote shares in select LGAs.The trend noted is likely a function of socio-demographic factors and the presence of party organizations, which is in keeping with data from previous studies of electoral geography in Lagos State (Adebayo, 2022; Okonkwo & Eze, 2023).

The chart (figure 3) that refers to the control charts for the turnout deviation and anomaly threshold via Z-score shows that Eti-Osa, Ikeja, and Surulere LGA have crossed the boundary of normal turnout. This trend points to locations where participation is statistically atypical, likely influenced by urban mobilization and strong local political involvement. In comparison to existing literature, our findings conform to research focusing on cities in Africa, which notes that urban electoral volatility is primarily pronounced within high-density urban centers (Ojo & Lawal, 2021; Nwafor, 2022). The anomalies underscore the need for computational verification to identify LGAs needing further forensic examination.

As shown in figure 4, the flow of evidence verification involving blockchain and artificial intelligence is indicated starting from input of electoral records, the verification by an AI, the generation of hash, validation of blockchain and lastly review by a tribunal. The visual affirmatively illustrates the study's conceptual argument that coupling AI with the blockchain enhances evidence integrity, auditability and traceability. This approach builds on previous research, which has separately noted the AI anomaly detection (Sharma & Gupta, 2025) and blockchain immutability (Khezr et al., 2025), to show a joint application for election tribunal.The workflow figure highlights the operational viability and transparency of the developed design. It provides a practical way to implement computational forensic accountability.

Machine learning model performances were compared in Figure 5. The results indicate that the unsupervised Isolation Forest model outperforms the supervised ones; Random Forest, Logistic Regression, and SVM in detecting unusual election patterns. This conclusion is evident from the higher accuracy, greater recall, and higher F1-scores of the Isolation Forest model. One reason is the unsupervised nature of Isolation Forest, which is able to detect rare anomalies better than models aware of class labels. These results fit well within the AI-forensics literature, which emphasizes unsupervised learning for anomaly detection when labeled data is not available (Li et al., 2024; Abdel-Basset et al., 2024). Based on this finding, election tribunals could adopt

Isolation Forest models to rank LGAs for forensic examination, thereby improvingefficiency, reliability and overall robustness of the validation of digital evidence.

The various figures combined authenticate that the use of spatial analysis, turnout anomaly detection, blockchain verification, and machine learning offered a multidimensional computationally grounded approach towards elections integrity. In addition to the tabular data, it contributes to the Blockchain-AI Forensic Accountability Framework we propose, and has broader implications for digital trust and institutional transparency as well as the SDG 16 objectives of accountable governance and strong institutions.

VI. CONCLUSIONS

This study shows that the combining of AI-based anomaly detection and Blockchain based evidence validation can potentially ensure the integrity of elections at tribunals. Data from the Lagos 2023 gubernatorial election reflected some expected spatial and vote-share patterns while the turnouts showed a few anomalies requiring further scrutiny. The AI verification was able to determine LGAs with unusual voting patterns. Also, blockchain hashing ensured the immutability of the election records. The Isolation Forest model outperformed other more traditional supervised learning models in this study, demonstrating the usefulness of unsupervised machine learning for rare anomaly detection.

Through regression and correlation analyses it has been established that the determinants of evidence integrity are the AI Verification Score and the Blockchain Validation Rate. Computational verification and tamper-proof validation are more important than vote totals. The findings as a whole back up the Blockchain-AI Forensic Accountability Framework (BAFAF) which offers an A scalable, transparent and trustworthy method of managing election tribunal evidence. The results are significant for digital governance and institutional accountability and have important implications for the achievement of SDG 16 goals. These results highlight how systems that reinforce evidence Computationally can enhance transparency, auditability, and public confidence in elections.

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