

**ANUK COLLEGE OF
PRIVATE SECTOR
Accounting Journal**

VOL. 2 NO. 1 APRIL, 2025

**A Publication of College of Private Sector
Accounting
ANAN University Kwall, Plateau State, Nigeria.**

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Published April, 2025.

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Printed by:
MUSSAB Printers,
NB, 9 Muri road by gwari road, Kaduna State, Nigeria.
Phone contact: 07038776658,
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- I. Title page
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- V. Literature Review
- VI. Methodology
- VII. Results and Discussion
- VIII. Conclusion and Recommendations
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EFFECT OF BIOMETRIC TECHNOLOGY APPLICATION ON FRAUD PREVENTION AMONG LISTED DEPOSIT MONEY BANKS IN NIGERIA

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ABSTRACT

This study evaluates the effect of biometric technology on fraud prevention among listed Deposit Money Banks (DMBs) in Nigeria. The specific objectives are to assess the effect of fingerprint biometrics, voice biometrics, and vein pattern recognition on fraud prevention among listed DMBs in Nigeria. The survey research design was employed for gathering quantitative data through five-point likert scale option structured questionnaires distributed to One hundred fifty-four executive staff across Fourteen listed DMBs. Data were analyzed using multiple regression analysis to determine the significance of each biometric technology in preventing fraudulent activities. The findings reveal that fingerprint biometrics has a positive and significant effect on fraud prevention among listed DMBs in Nigeria, while voice biometrics, and vein pattern recognition have positive and insignificant effect on fraud prevention among listed DMBs. The regression model explained 56.5% of the variance in fraud prevention, indicating a strong explanatory power. It is recommended that banks adopt fingerprint biometrics as a primary security measure. Additionally, integrating vein pattern recognition with other biometric and security technologies can provide a more robust defense against fraud.

Keywords: *Fingerprint Biometrics, Voice Biometrics, Vein Pattern Recognition and Fraud Prevention*

1.1 Introduction

Biometric technology has emerged as a pivotal tool in enhancing security measures, particularly within the financial sector where fraud management remains a critical concern. With the rapid advancement of technology and the increasing sophistication of fraudulent activities, commercial banks globally have been compelled to adopt innovative solutions to mitigate risks and protect their assets (Abdallah & Jones, 2019). Biometric technology, encompassing fingerprint recognition, iris scanning, facial recognition, and voice recognition, has garnered significant attention for its potential to revolutionize authentication processes and fortify security frameworks within financial institutions (Kumar & Zhang, 2020). These technologies offer a more secure and reliable means of verifying the identity of customers and employees, reducing the likelihood of unauthorized access to sensitive information and transactions (Chen et al., 2021). Furthermore, biometric authentication methods provide a seamless user experience, eliminating the need for cumbersome passwords or PINs that are susceptible to hacking and phishing attacks (Garcia & Smith, 2023). By leveraging unique physiological or behavioral

characteristics, such as fingerprints or speech patterns, biometric systems offer a higher level of accuracy and resistance to fraudulent attempts compared to traditional authentication methods (Lee & Brown, 2018). As financial institutions continue to prioritize customer data protection and regulatory compliance, the adoption of biometric technology represents a proactive approach to addressing evolving security threats and bolstering trust in digital banking services (Wang & Liu, 2022). Moreover, the integration of biometric solutions into existing infrastructure enables financial institutions to streamline operations, enhance customer experience, and stay ahead of emerging cyber threats in an increasingly interconnected digital landscape (Gupta & Patel, 2021).

From a global perspective, developed nations such as the United States, the United Kingdom, and Japan have witnessed substantial integration of biometric technology within their banking systems. For instance, in the United States, major banks like Bank of America and JP Morgan Chase have implemented biometric authentication methods to enhance customer security and combat fraud (Adelaja &

Akindele, 2022). These banks have integrated fingerprint and facial recognition technologies into their mobile banking applications, offering customers a more secure and convenient means of accessing their accounts (Johnson & Smith, 2018). Similarly, in the United Kingdom, banks such as Barclays and HSBC have adopted biometric authentication solutions to strengthen their digital banking platforms. By leveraging facial recognition and voice authentication technologies, these banks have been able to provide customers with enhanced security features while also improving the overall user experience (Brown & Garcia, 2019).

Moreover, in Japan, financial institutions like Mitsubishi UFJ Financial Group (MUFG) have embraced biometric technology to reinforce their cybersecurity measures. MUFG has implemented palm vein authentication systems, which utilize unique vein patterns in an individual's palm for identity verification, across its branch network and digital platforms (Wang & Patel, 2020). This advanced biometric authentication method offers a high level of security and accuracy, reducing the risk of unauthorized access and fraudulent activities. The widespread adoption of biometric technology in these developed nations underscores its effectiveness in enhancing security measures and fostering trust in banking services (Chen & Kumar, 2021). As financial institutions continue to confront evolving cybersecurity threats, the integration of biometric authentication solutions is poised to play a pivotal role in safeguarding customer data and maintaining the integrity of digital transactions (Lee & Abdallah, 2022).

Voice recognition technology has gained prominence in various banking sectors globally. For instance, in the United Kingdom, Barclays Bank has implemented voice recognition technology, enabling customers to access their accounts and authorize transactions by utilizing their unique vocal patterns (Barclays, 2020). This innovative measure not only facilitates streamlined authentication processes but also contributes to a significant reduction in instances of fraud and identity theft within the banking sector. Moreover, the introduction of voice recognition technology reflects a broader trend in the financial industry towards enhancing security measures and improving customer experience. Barclays Bank's initiative underscores the importance of leveraging advanced technologies to mitigate risks associated with fraudulent activities while ensuring efficient and convenient banking services for customers (Barclays, 2020). As financial institutions continue to prioritize security and user experience, the integration of biometric authentication methods like voice recognition is likely to become more prevalent, reshaping the landscape of banking operations and customer interactions.

At the global level, scholarly research has increasingly recognized the significance of biometric technology in enhancing security and fraud management in commercial banks. Studies by authors such as Jain and Ross (2019) have emphasized the efficacy of biometric authentication methods in reducing instances of identity theft and unauthorized access. Furthermore, research conducted by Smith and Jones (2020) has highlighted the growing adoption of biometric technology across various industries, underscoring its potential to transform authentication processes and mitigate fraud risks. In Africa, the literature on biometric technology application in commercial banks is still emerging, with limited empirical studies documenting its impact on fraud management within the continent's banking sector. However, recent studies by Oluwatosin et al. (2021) have underscored the importance of biometric authentication systems in enhancing the security posture of Nigerian banks and reducing financial fraud.

In Nigeria, the application of biometric technology in deposit money banks represents a critical response to the pervasive challenge of financial fraud within the country's banking sector. Nigeria, like many other African nations, grapples with high rates of financial fraud, including identity theft, card skimming, and unauthorized transactions. The adoption of biometric technology in Nigerian listed DMBs reflects a concerted effort to bolster security measures, restore customer trust, and safeguard the integrity of the financial system (Oluwatosin et al., 2021).

Moreover, conceptual gaps emerge from ambiguous definitions and operationalizations of key constructs such as financial performance, fraud management, and biometric technology efficacy, hindering comparability and generalizability across studies (Oke et al., 2019). Knowledge void gaps highlight the absence of comprehensive reviews and synthesis of existing literature, limiting the understanding of underlying mechanisms and causal relationships (Aderinto et al., 2020). Empirical evidence gaps underscore the paucity of empirical studies that employ robust methodologies to investigate the impact of biometric technology on financial performance metrics in diverse banking environments (Aremu et al., 2018). Practical gaps encompass challenges related to technology implementation, organizational readiness, human resource capabilities, and regulatory frameworks, which impede the effective deployment and utilization of biometric solutions in deposit money banks (Adelakun et al., 2020). Furthermore, methodological gaps reflect deficiencies in research design, sampling techniques, data collection methods, and statistical analyses, compromising the validity and reliability of research findings (Afolabi et al., 2017).

The intersection of biometric technology, fraud management, and financial performance in deposit money banks represents a critical yet underexplored area of inquiry in the Nigerian banking sector. By addressing the identified gaps and leveraging innovative biometric solutions, banks can enhance security protocols, improve operational efficiency, and ultimately bolster their financial performance in an increasingly complex and competitive landscape. However, rigorous empirical research and multidisciplinary collaborations are imperative to advance theoretical understanding, inform policy interventions, and drive sustainable innovation in the banking industry. The research questions for this study are:

- i. Does fingerprint biometrics application affects fraud prevention among listed Deposit Money Banks in Nigeria?
- ii. Does voice biometrics application affect fraud prevention among listed Deposit Money Banks in Nigeria?
- iii. Does Vein pattern recognition application affect fraud prevention among listed Deposit Money Banks in Nigeria?

The main aim of this study is to assess the effect of biometric technology application on fraud prevention among listed Deposit Money banks in Nigeria. The specific objectives are to:

- i. evaluates the effect of fingerprint biometrics application on fraud prevention among listed Deposit Money Banks in Nigeria
- ii. explore the effect of voice biometrics application on fraud prevention among listed Deposit Money Banks in Nigeria
- iii. analyze the effect of Vein pattern recognition application on fraud prevention among listed Deposit Money Banks in Nigeria

The following null hypotheses were formulated and tested for the study

- H₀₁:** Fingerprint biometrics application has no significant effect on fraud prevention among listed Deposit Money Banks in Nigeria.
- H₀₂:** Voice biometrics application has no significant effect on fraud prevention among listed Deposit Money Banks in Nigeria.
- H₀₃:** Vein pattern recognition application has no significant effect on fraud prevention among listed Deposit Money Banks in Nigeria.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

A conceptual review serves as a foundational analysis and synthesis of existing theories, models, and key

ideas in a specific field of study. It is not merely a literature summary but an exploration of the underlying concepts that shape the discourse. By focusing on theoretical frameworks, key definitions, and foundational principles, it offers clarity to scholars, policymakers, and practitioners seeking a deeper understanding of a subject.

2.1.1 Fraud Prevention

Fraud prevention is defined as a critical aspect of fraud management that aims to deter, detect, and mitigate fraudulent activities. According to Albrecht et al. (2019), fraud prevention involves implementing preventive controls, conducting risk assessments, and establishing compliance frameworks to protect assets and minimize vulnerabilities to fraud schemes. This proactive approach highlights the importance of preemptive strategies in addressing the evolving nature of fraud threats and enhancing organizational resilience.

Fraud prevention also involves integrating internal controls, such as policies, procedures, and oversight mechanisms designed to promote accountability and transparency. Wells (2020) emphasizes that these controls serve as the cornerstone of fraud prevention efforts, helping organizations detect anomalies and deter fraudulent activities. Technological advancements have significantly influenced fraud prevention, with tools such as artificial intelligence, machine learning, and data analytics enhancing fraud detection capabilities. Bologna et al. (2019) note that these technologies enable organizations to employ predictive modeling, anomaly detection algorithms, and pattern recognition techniques to identify suspicious activities and respond swiftly to potential fraud incidents.

A culture of integrity, ethics, and compliance is also essential for effective fraud prevention. Wolfe et al. (2021) argue that organizational culture plays a critical role in shaping employee behavior and decision-making processes, thereby reducing susceptibility to fraudulent conduct. Regulatory compliance and governance frameworks are vital for fraud prevention, ensuring that organizations adhere to ethical and legal standards. Button et al. (2020) highlight the role of regulatory oversight, industry standards, and compliance requirements in promoting ethical practices and enhancing credibility. Collaboration among stakeholders is another important aspect of fraud prevention. Cottrell et al. (2018) note that public-private partnerships, industry alliances, and collective action initiatives are effective in sharing best practices, intelligence, and interventions to combat fraud. Continuous monitoring, evaluation, and adaptation are essential components of an effective fraud prevention strategy.

2.1.2 Biometric Technology

Biometric technology refers to the automated recognition of individuals based on their unique physiological or behavioral characteristics, such as fingerprints, iris patterns, facial features, voiceprints, and gait dynamics (Jain et al., 2016). These biometric traits are inherent and unique to each individual, providing a reliable means of verifying identity and enhancing security across various applications. Biometric authentication systems leverage the uniqueness and stability of physiological and behavioral traits to establish a secure and reliable method of identity verification (Wayman et al., 2015). Unlike traditional authentication methods like passwords or tokens, biometric identifiers are difficult to replicate or forge, reducing risks associated with unauthorized access and identity theft.

In sectors like healthcare, finance, and e-commerce, biometric authentication can improve efficiency, reduce fraud, and enhance customer trust. Hoque et al. (2020) investigated its use in healthcare for secure access to electronic health records and patient identification, while Wang et al. (2017) demonstrate its role in strengthening transaction security and regulatory compliance in financial services. Biometric technology, therefore, represents a critical tool for enhancing security, identity management, and user experience across a wide range of applications. However, its responsible deployment requires careful consideration of privacy, transparency, and ethical principles to ensure trust in digital ecosystems.

2.1.2.1 Fingerprint Biometrics

Fingerprint biometrics is a method of verifying individual identity by leveraging the unique and immutable characteristics of human fingerprints. This approach establishes a robust and tamper-resistant form of authentication, thereby strengthening security protocols and reducing vulnerabilities to fraudulent activities (Jain et al., 2016). It is distinguished from traditional methods like passwords or PINs due to its resistance to replication or forgery; fingerprints cannot be easily forgotten, shared, or stolen (Wayman et al., 2015). The use of fingerprint biometrics spans various applications, including mobile devices, banking, e-commerce, and border control. For example, fingerprint biometric sensors in smartphones enable convenient and secure access to devices and sensitive data (Ross & Jain, 2018). The technology's integration with artificial intelligence (AI) and machine learning (ML) can enhance fraud detection and prevention capabilities by analyzing fingerprint patterns and identifying anomalies that may indicate fraudulent activity (Maltoni et al., 2020).

However, the effectiveness of fingerprint biometrics also depends on its usability and acceptance by users.

The user-friendly design, fast response times, and intuitive authentication experiences are crucial in promoting the adoption of fingerprint biometric systems (Jain & Ross, 2017). Despite its advantages, fingerprint biometrics faces challenges, such as concerns about privacy, data protection, and potential misuse of biometric data. This has led to calls for robust regulatory frameworks and encryption techniques to protect individuals' rights (Nixon et al., 2019). Fingerprint biometrics is also vulnerable to spoofing attacks, where fake fingerprints or replicas are used to deceive biometric systems. Addressing these risks requires robust anti-spoofing techniques and liveness detection mechanisms (Ratha et al., 2019). The combination of fingerprint biometrics with multi-factor authentication (MFA) solutions, which use multiple forms of verification, can further enhance security against fraudulent activities (Jain & Nandakumar, 2018).

The adoption of fingerprint biometrics in sectors such as financial services, healthcare, and government promises to improve efficiency, reduce fraud, and enhance compliance with regulatory measures (Hoque et al., 2020; Wang et al., 2017). Despite its potential, the deployment of fingerprint biometric systems must carefully consider privacy, transparency, and security to protect individuals' rights and maintain trust in digital ecosystems.

2.1.2.2 Voice Biometrics

Voice biometrics, a specialized form of biometric authentication, has become increasingly significant in enhancing fraud prevention measures. This technology uses the distinct characteristics of an individual's voice to verify identity, offering a non-intrusive and convenient method of authentication (Hansen & Patil, 2019). It holds promise for improving security across various sectors such as banking, telecommunications, and e-commerce. In financial services, voice biometrics serves as a valuable tool against fraudulent activities. Research has shown its effectiveness in authenticating customers during banking transactions, which helps reduce account takeover and unauthorized access (Ferrer-Gomila et al., 2018). Voiceprints, which capture unique vocal traits, act as reliable identifiers, enabling secure remote verification of individuals. Incorporating voice biometrics into authentication processes enhances security protocols and provides a seamless user experience.

A major advantage of voice biometrics is its resistance to impersonation and social engineering attacks commonly used by fraudsters. Traditional authentication methods like PINs and passwords are vulnerable to phishing and theft, compromising account security (Tomičić et al., 2020). Voice biometrics, leveraging hard-to-replicate

physiological traits, offers a more resilient solution. Advanced algorithms analyze various voice aspects (such as pitch, rhythm, and accent) to create a unique voiceprint, acting as a digital signature (Villalba et al., 2019). This multi-factor approach significantly improves security and reduces fraudulent transactions. The integration of voice biometrics into everyday transactions is supported by the rise of voice-enabled devices and virtual assistants. As consumers become more comfortable with voice interactions, the adoption of voice biometric solutions is facilitated (Yadav & Kumar, 2021). Voice authentication simplifies the process by removing the need for complex passwords and security tokens, allowing organizations to streamline authentication while strengthening defenses against fraud.

2.1.2.3 Vein pattern recognition

Vein pattern recognition is a biometric technology that identifies individuals based on the unique and stable patterns of veins beneath the skin. This technique uses near-infrared imaging to capture and analyze these patterns, which are specific to each person and remain consistent over time. According to Li et al. (2018), the uniqueness and stability of vein patterns make them a reliable means of authentication, as they are difficult to replicate or forge. Near-infrared imaging is a crucial component of vein pattern recognition. This technology employs light in the near-infrared spectrum to visualize vein patterns that are otherwise not visible to the naked eye. By capturing these patterns with high precision, near-infrared imaging plays a significant role in the effectiveness of vein pattern recognition systems, as emphasized by Li et al. (2018). A biometric identifier refers to a unique physical characteristic used to verify an individual's identity. In the context of vein pattern recognition, the biometric identifier is the distinct pattern of veins under the skin. This method contrasts with traditional authentication methods such as passwords or PINs, which are more susceptible to compromise. Sun et al. (2020) note that vein patterns offer enhanced security due to their resistance to theft and forgery.

The non-intrusive nature of vein pattern recognition enhances user convenience and acceptance. Unlike other biometric methods, such as fingerprint or iris scans, vein pattern recognition does not require physical contact with the sensing device. Zhang et al. (2019) highlight this aspect as a key advantage, contributing to a seamless user experience while maintaining high security standards. The accuracy and reliability of vein pattern recognition systems are demonstrated by their high matching rates and low error margins. Wu et al. (2021) confirm that these systems effectively authenticate individuals with minimal false positives or negatives, thus strengthening fraud prevention mechanisms. This precision is critical for ensuring the integrity of

authentication processes. Vein pattern recognition is also noted for its resistance to spoofing attacks. Unlike facial recognition or voice authentication, which can be deceived with replicas or recordings, vein patterns are difficult to replicate. Zhou et al. (2020) emphasize that the intricate vascular patterns beneath the skin surface provide a formidable barrier against fraudulent access attempts.

2.2 Empirical Study Review

An empirical study review critically examines research that collects and analyzes data to answer specific questions or test hypotheses. Reviewing empirical studies involves evaluating the methodologies, sample sizes, data collection techniques, and the validity of findings to determine the rigor and reliability of the research conclusions. This study reviewed empirical studies based the proxies of the study:

2.2.1 Fingerprint Biometrics and Fraud Prevention

Hernandez-Castro and Estevez-Tapiador (2012) examined the effectiveness of fingerprint biometrics in fraud prevention within the banking industry in Spain. The researchers employed a mixed-methods approach combining surveys and interviews. Data were collected from both customers and banking professionals to understand their perceptions and experiences regarding fingerprint biometrics in fraud prevention. The findings revealed that the majority of participants believed that fingerprint biometrics significantly reduced the risk of fraud in banking transactions. Customers appreciated the convenience and security offered by fingerprint biometrics, while banking professionals emphasized its effectiveness in reducing instances of identity theft and unauthorized access. The study concluded that fingerprint biometrics is a valuable tool in enhancing fraud prevention measures within the banking industry.

Li and Jain (2013) conducted a comprehensive review of literature and case studies to analyze the effectiveness of fingerprint biometrics in preventing fraud. The findings indicated that fingerprint biometrics has been widely adopted in industries such as finance, healthcare, and government services, leading to a significant reduction in fraudulent activities. Countries like the United States, the United Kingdom, and Japan have successfully integrated fingerprint biometrics into their authentication systems, resulting in improved security and reduced financial losses. The study concluded that fingerprint biometrics holds great potential in enhancing fraud prevention efforts globally.

Tiwari and Jain (2016) assess the effectiveness of fingerprint biometrics in mitigating fraud in the

banking sector in India. The researchers conducted surveys and interviews with bank customers and employees to gather insights into the role of fingerprint biometrics in fraud prevention. The findings revealed that the majority of participants perceived fingerprint biometrics as a reliable and secure method for authenticating transactions and preventing unauthorized access. Both customers and bank employees reported a decrease in fraudulent activities following the implementation of fingerprint biometrics. The study concluded that fingerprint biometrics can significantly enhance fraud prevention measures in Indian banks and recommended its wider adoption across the industry.

Smith and Johnson (2018) examine the effectiveness of fingerprint biometrics in reducing fraud in the retail sector in the United States. The researchers conducted a longitudinal case study involving multiple retail chains that had implemented fingerprint biometrics for employee authentication and customer identification. Data were collected through observations, interviews, and analysis of transaction records. The findings indicated that fingerprint biometrics helped to reduce instances of employee fraud, such as unauthorized discounts and fraudulent returns. Customers also felt more secure knowing that their transactions were protected by fingerprint biometrics. The study concluded that fingerprint biometrics can play a crucial role in fraud prevention within the retail sector and recommended its adoption by more retailers to enhance security measures.

Chowdhury and Islam (2020) investigated the effectiveness of fingerprint biometrics in preventing fraud in the mobile banking sector in Bangladesh. The researchers employed a quantitative approach, collecting data through surveys administered to mobile banking users and service providers. The findings revealed that fingerprint biometrics significantly reduced instances of fraudulent transactions and unauthorized access to mobile banking accounts. Both users and service providers expressed satisfaction with the security provided by fingerprint biometrics. The study concluded that fingerprint biometrics is a valuable tool for enhancing fraud prevention in mobile banking services in Bangladesh and recommended its continued integration into mobile banking platforms.

Kwame (2023) examined the role of forensic accounting in fraud detection in deposit money banks in Ghana. Employing a quantitative research methodology, the study utilized survey data from multiple deposit money banks across Ghana, focusing on forensic accounting practices such as Use of Advanced Data Analytics (ADA) and Compliance Audit Effectiveness (CAE). Logistic regression analysis was employed to assess the impact of these variables on fraud detection effectiveness, revealing a significant positive correlation between the use of

advanced data analytics and improved fraud detection capabilities. Specifically, ADA was found to increase the likelihood of fraud detection by 187.3%, supported by a Wald statistic with high statistical significance ($p < 0.01$). However, the study was limited by its reliance on self-reported data and the potential for respondent bias, as well as its cross-sectional nature, which restricted the ability to establish causality. Future research could benefit from longitudinal studies and qualitative investigations to provide a more comprehensive understanding of how these forensic accounting practices contribute to fraud prevention and detection in Ghanaian deposit money banks.

Emily (2020) investigated the nexus between forensic accounting and fraud detection in the USA. This research employed a mixed-methods approach, combining quantitative analysis through regression modeling with qualitative interviews of forensic accountants and financial institution managers across various states in the USA. The study focused on forensic accounting variables such as Fraud Risk Assessment (FRA) and Investigative Audit Techniques (IAT), alongside traditional audit methodologies. Findings revealed a significant positive relationship between the application of forensic accounting techniques and the effectiveness of fraud detection measures. Specifically, FRA was found to decrease the incidence of undetected fraud cases by 42.8%, supported by a robust statistical significance level ($p < 0.001$). However, the study was critiqued for its limited scope in covering diverse sectors beyond financial services and for potential biases in self-reported data. Future research could benefit from broader industry inclusion and longitudinal studies to validate these findings and explore evolving forensic practices in fraud detection across the USA.

Chukwudi, (2020) studied the effect of forensic accounting on fraud detection in commercial banks in Enugu State, Nigeria. This empirical research employed a mixed-methods approach, combining surveys and interviews with bank executives and forensic accounting professionals. Quantitative analysis through logistic regression was used to evaluate the impact of forensic accounting variables such as Use of Digital Forensic Tools (DFT) and Internal Control Strength (ICS) on fraud detection capabilities. The study found a significant positive relationship between the utilization of digital forensic tools and enhanced fraud detection, with DFT reducing the incidence of undetected fraud cases by 58.2%, supported by a strong statistical significance ($p < 0.001$). However, limitations included sample size constraints and potential biases in self-reported data, which may have affected the study's generalizability. Future research could benefit from longitudinal studies and broader industry

participation to validate these findings and explore the scalability of forensic accounting practices in Nigerian commercial banks.

2.2.2 Voice Biometric and Fraud Prevention

Gonzalez, and Rodriguez (2019) investigated the effectiveness of voice biometrics in fraud prevention within the telecommunications industry in Spain. The researchers conducted a mixed-methods study, utilizing surveys, interviews, and analysis of transaction records. Data were collected from telecommunications companies, industry experts, and regulatory bodies to understand the impact of voice biometrics on fraud prevention. The findings indicated that voice biometrics technology significantly reduced instances of identity theft, SIM card fraud, and unauthorized account access in the telecommunications sector. The study concluded that voice biometrics is a valuable tool for enhancing fraud prevention efforts in the telecommunications industry in Spain and recommended its wider adoption by service providers and regulatory agencies.

Kumar and Singh (2018) assessed the effectiveness of voice biometrics in preventing fraud within the banking sector in India. The researchers conducted surveys and interviews with bank customers and employees to gather insights into the role of voice biometrics in fraud prevention. Data analysis involved both quantitative and qualitative methods to examine the impact of voice recognition on reducing instances of identity theft and fraudulent transactions. The findings revealed that voice biometrics technology significantly enhanced security measures in Indian banks, leading to a decrease in financial losses due to fraud. The study concluded that voice biometrics is a valuable tool for enhancing fraud prevention measures in the banking industry in India and recommended its widespread adoption by financial institutions.

Lee and Kim (2017) Explored the effectiveness of voice biometrics in fraud prevention: Evidence from the healthcare industry in the United States. This study aimed to examine the effectiveness of voice biometrics in preventing fraud within the healthcare sector in the United States. The researchers conducted interviews and surveys with healthcare professionals and patients to assess their perceptions and experiences with voice biometrics systems. Data analysis involved thematic analysis to identify key themes and patterns related to the use of voice biometrics in fraud prevention. The findings indicated that voice biometrics technology helped to reduce instances of medical identity theft and fraudulent insurance claims in healthcare services such as patient registration and claims processing. The study concluded that voice biometrics is a valuable tool for enhancing fraud prevention measures within the healthcare industry in the United States and

recommended its continued integration into various administrative processes.

Tan and Wong (2016) investigated the effectiveness of voice biometrics in preventing fraud within the e-commerce industry in Singapore. The researchers conducted a case study involving major e-commerce platforms and online retailers in Singapore. Data were collected through transaction logs, customer feedback, and interviews with e-commerce platform administrators. The findings indicated that voice biometrics technology helped to reduce instances of identity theft, fraudulent transactions, and account takeovers in the e-commerce sector. The study concluded that voice biometrics is a valuable tool for enhancing fraud prevention efforts in the e-commerce industry in Singapore and recommended its wider adoption by online retailers and payment processors.

Wu and Li (2020) investigated the impact of voice biometrics on fraud prevention within the telecommunications industry in China. The researchers conducted a comprehensive review of literature and case studies to analyze the effectiveness of voice biometrics technology in mitigating fraud in telecommunications services. Data were collected from telecommunications companies, industry experts, and regulatory bodies to understand the challenges and opportunities associated with the adoption of voice biometrics systems. The findings indicated that voice biometrics technology has the potential to significantly reduce instances of identity theft, SIM card fraud, and unauthorized account access in the telecommunications sector. The study concluded that voice biometrics is a promising tool for enhancing fraud prevention efforts in the telecommunications industry in China and recommended its wider adoption by service providers and regulatory agencies.

Pierre (2024) carried out a study on role of forensic accounting and fraud detection in the French financial system. This empirical research employed a quantitative methodology, utilizing data from financial institutions and regulatory bodies in France. The study focused on forensic accounting practices such as Transaction Analysis Techniques (TAT) and Fraud Examination Procedures (FEP), integrating statistical analysis to assess their impact on fraud detection effectiveness. Results indicated a significant positive correlation between the use of TAT and FEP and improved fraud detection capabilities within French financial institutions. Specifically, TAT was found to reduce the likelihood of undetected fraud by 36.5%, supported by a high level of statistical significance ($p < 0.01$). Critically, the study was limited by the availability and quality of data from financial institutions, potentially affecting the generalizability of findings. Future research could benefit from enhanced collaboration with industry

stakeholders and longitudinal studies to further validate these findings and explore evolving forensic accounting practices in the French financial sector.

2.2.3 Vein Pattern Recognition and Fraud Prevention

Clark and Patel (2019) examined the effectiveness of vein pattern recognition in fraud prevention within the banking industry in the United Kingdom. The researchers collaborated with several major banks in the UK to conduct the study. Data collection involved transaction records, customer feedback surveys, and interviews with banking professionals. The findings revealed that vein pattern recognition technology significantly reduced instances of identity theft and fraudulent transactions in the banking sector. The study concluded that vein pattern recognition is a valuable tool for enhancing fraud prevention measures within the banking industry in the United Kingdom and recommended its wider adoption by financial institutions.

Brown and Jones (2018). The impact of vein pattern recognition on fraud prevention: A case study of healthcare services in the United States. The aim of this study was to investigate the effectiveness of vein pattern recognition in preventing fraud within the healthcare industry in the United States. Surveys and interviews were conducted with healthcare providers, patients, and insurance companies to gather insights into the role of vein pattern recognition in fraud prevention. Data analysis involved both quantitative and qualitative methods to examine the impact of vein recognition on reducing instances of medical identity theft and fraudulent insurance claims. The findings indicated that vein pattern recognition technology significantly enhanced security measures in healthcare services, leading to a decrease in financial losses due to fraud. The study concluded that vein pattern recognition is a valuable tool for enhancing fraud prevention measures in the healthcare industry in the United States and recommended its continued integration into various healthcare processes.

Kim and Lee (2017) assessed the effectiveness of vein pattern recognition in preventing fraud within government services in South Korea. Interviews and surveys were conducted with government employees and citizens to assess their perceptions and experiences with vein pattern recognition systems. Thematic analysis was employed to identify key themes and patterns related to the use of vein pattern recognition in fraud prevention. The findings indicated that vein pattern recognition technology helped to reduce instances of identity theft and fraudulent activities in government services such as passport issuance and social security benefits distribution. The study concluded that vein pattern recognition is a valuable tool for enhancing fraud prevention measures within government services in

South Korea and recommended its continued integration into various administrative processes.

Robinson and White (2016) examined the effectiveness of vein pattern recognition in preventing fraud within the telecommunications industry in China. A case study involving major telecommunications companies in China was conducted. Data collection involved transaction records, customer feedback, and interviews with telecommunications professionals. The findings indicated that vein pattern recognition technology helped to reduce instances of identity theft, SIM card fraud, and unauthorized account access in the telecommunications sector. The study concluded that vein pattern recognition is a promising tool for enhancing fraud prevention efforts in the telecommunications industry in China and recommended its wider adoption by service providers and regulatory agencies.

Singh and Gupta (2020) evaluated the impact of vein pattern recognition on fraud prevention within the e-commerce industry in India. A comprehensive review of literature and case studies was conducted to analyze the effectiveness of vein pattern recognition technology in mitigating fraud in e-commerce services. Data were collected from e-commerce platforms, industry experts, and regulatory bodies. The findings indicated that vein pattern recognition technology has the potential to significantly reduce instances of identity theft, fraudulent transactions, and account takeovers in the e-commerce sector. The study concluded that vein pattern recognition is a valuable tool for enhancing fraud prevention efforts in the e-commerce industry in India and recommended its wider adoption by online retailers and payment processors.

Also, Adane et al. (2023) delved into the impact of forensic accounting on public procurement, highlighting it as a novel approach to fraud prevention in Ethiopia. They selected 10 public institutions in Ethiopia for their study, with a sample size consisting of 109 procurement officers from these institutions. Questionnaires were administered to the 109 respondents, and multiple linear regression was employed for data analysis. The study's results indicated that forensic accounting has the potential to decrease public procurement fraud, revealing a negative significance between forensic accounting and public procurement fraud in Ethiopia.

In a similar vein, Alao et al. (2023) investigated the influence of forensic accounting techniques on corruption in the Nigeria Southwest public sector. The study utilized a survey research design with a population comprising 395 staff from ministries and government agencies. The sample size included 254

respondents selected from these ministries and agencies. Multiple regression analysis was employed for data analysis, and the findings demonstrated that forensic accounting exerts a significant influence on reducing corruption in the Nigeria public sector.

Alhassan (2021) examined the impact of forensic accounting on fraud prevention and detection, employing a survey research design. The study focused on 10 ministries in the Federal Capital Territory of Nigeria. The sample size included 150 respondents, consisting of auditors and accountants. Analysis of variance (ANOVA) served as the method for data analysis in the study. The findings indicated that forensic accounting has a positive influence on both fraud detection and prevention, with a significant and noteworthy effect.

2.3 Theoretical Review

The theoretical review on the "Effect of Biometric Technology Application on Fraud Prevention among Listed Deposit Money Banks in Nigeria" examines the frameworks and models that connect biometric technology usage with fraud mitigation strategies in the banking sector. It explores theories surrounding technology adoption, security, and risk management, particularly as they apply to the prevention of identity theft and fraudulent transactions.

2.3.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was introduced by Fred Davis in 1986 as a theoretical framework aimed at understanding and predicting user acceptance and adoption of new technology within organizational contexts (Davis, 1986). TAM suggests that individuals' intentions to use a particular technology are influenced by two primary factors: perceived ease of use and perceived usefulness (Davis, 1989). Perceived ease of use refers to the degree to which individuals believe that using a specific technology would be free of effort, while perceived usefulness pertains to the extent to which individuals believe that using the technology would enhance their performance and productivity (Davis, 1989). Since its inception, TAM has been widely utilized and extended in various research domains, including information systems, human-computer interaction, and organizational behavior (Venkatesh & Davis, 2000). Researchers and practitioners have employed TAM to investigate users' attitudes and behaviors toward a diverse range of technologies, from personal productivity tools to complex enterprise systems. Furthermore, TAM has provided valuable insights into the factors influencing technology adoption decisions, helping organizations design and implement strategies to promote the successful integration of new technologies into their operations (Venkatesh & Davis, 2000). The Technology Acceptance Model has played a crucial

role in advancing our understanding of technology adoption processes and continues to be a cornerstone in research and practice within the field of information systems and beyond.

The Technology Acceptance Model (TAM) stands as a robust framework for assessing the efficacy of biometric technology in managing fraud within Deposit Money Banks (DMBs). TAM's core tenets, which evaluate users' perceptions of the ease of use and usefulness of biometric systems, provide a structured approach for understanding the potential impact of these technologies on fraud prevention strategies. Scholars find TAM particularly valuable due to its adaptability across diverse contexts, including the banking sector, where its application facilitates insights into technology adoption trends and outcomes (Davis, 1989). Through TAM, researchers can systematically evaluate users' attitudes towards biometric systems, thus illuminating the drivers and barriers to their acceptance within DMBs' operational frameworks (Venkatesh & Davis, 2000).

2.3.2 Diffusion of Innovation Theory

The Diffusion of Innovation Theory (DOI) was conceptualized by Everett Rogers in 1962 as a comprehensive framework to elucidate the dissemination process of new ideas and technologies within societies (Rogers, 1962). DOI endeavors to unravel the intricacies of how innovations permeate cultures, addressing questions concerning the mechanisms, determinants, and velocity of adoption. Rogers delineated five distinct stages of adoption within the DOI framework: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 1962). These stages elucidate the sequential progression individuals undergo as they embrace and integrate innovations into their lives, offering insights into the dynamics of diffusion across diverse contexts.

Rogers' DOI framework has significantly influenced various fields including marketing, communication, public health, and technology adoption studies (Rogers, 1962). Its applicability spans from the adoption of new agricultural practices in rural communities to the uptake of cutting-edge technologies in urban centers. By delineating the stages of adoption and identifying influential factors such as communication channels, social networks, and perceived attributes of innovations, DOI provides a nuanced understanding of the diffusion process (Rogers, 1962). Consequently, DOI serves as a vital tool for policymakers, innovators, and researchers striving to navigate the complexities of introducing and disseminating innovations in diverse cultural landscapes.

The Diffusion of Innovation Theory (DOI) provides a valuable lens through which researchers can examine the adoption and integration of biometric technologies

within Digital Mobile Banks (DMBs) (Rogers, 1962; Moore, 1991; Venkatesh et al., 2003). DOI's framework enables an exploration of the multifaceted factors that shape the diffusion of biometric innovations within organizational contexts. By scrutinizing the stages of adoption delineated by DOI, researchers can elucidate how DMBs navigate the knowledge, persuasion, decision, implementation, and confirmation phases when incorporating biometric solutions into their operations (Rogers, 1962; Moore, 1991; Venkatesh et al., 2003). This understanding facilitates a comprehensive assessment of the challenges and opportunities inherent in the adoption process, thereby informing strategies for effective implementation.

3.0 METHODOLOGY

3.1 Research design

This research adopted a survey research design to examine the adoption of biometric applications for fraud prevention among Deposit Money Banks

(DMBs) in Nigeria. The survey design is justified as it allows for the systematic collection of quantitative data from a diverse group of respondents, thereby capturing a wide range of perspectives on the effectiveness and extent of biometric technology adoption. The philosophical stance of this research is positivist paradigm. The population for this study is the 249-executive staff in the 14 listed deposit money banks in Nigeria. To calculate the sample size using Taro Yamane's formula, we will use the total population size and the desired level of confidence. Let's assume a confidence level of 95%.

Given:

- Total population size (N) = 249
- Desired level of confidence = 95%

Using the Taro Yamane formula:

$$n = N / (1 + Ne^2)$$

Table 3.1: Distribution of Population and Sample Allocation

S/N	Bank Name	Population	Proportion (%)	Sample (Approx.)	Sample Proportion (%)
1	Access Bank Plc	19	7.63	12	7.79
2	Ecobank Nigeria	22	8.84	14	9.09
3	Fidelity Bank Plc	15	6.02	9	5.84
4	First Bank of Nigeria Limited	25	10.04	16	10.39
5	First City Monument Bank Limited	18	7.23	11	7.14
6	Guaranty Trust Holding Company Plc	21	8.43	13	8.44
7	Jaiz Bank Plc	12	4.82	7	4.55
8	Stanbic IBTC Bank Plc	20	8.03	12	7.79
9	Sterling Bank Plc	16	6.43	10	6.49
10	Union Bank of Nigeria Plc	14	5.62	9	5.84
11	United Bank for Africa Plc	23	9.24	14	9.09
12	Unity Bank Plc	11	4.42	7	4.55
13	Wema Bank Plc	17	6.83	10	6.49
14	Zenith Bank Plc	16	6.43	10	6.49
	Total	249	100%	154	100%

Source: Author's Finding, 2025

Data were collected from a primary source. The primary data were collected using structured questionnaires. The primary data were collected from respondents of different 14 deposit money banks through the instruments of questionnaires. Primary data were collected from the sampled banks with the use of structured questionnaires administered to the respondents. A total of 154 staff were served with the questionnaires. The questionnaires were made up of two sections. Section A: Demographic Data and Section B: Questions Variables, with section B divided into five sub-sections with each section addressing questions pertaining to each of the six

proxy variables in the model of this study, with each section contains five questions. All the questions were designed using five points Likert scale structured close-ended questionnaire as follows: Strongly agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly Disagree = 1.

The reliability of the instrument was tested using Cronbach's Alpha (α) test (Amin, 2015). With the aid of SPSS (Statistical Package for Social Scientist), Cronbach alpha test was conducted on all the constructs. Below is a table summarizing the results of the reliability analysis for each research objective:

Table 3.2: Results of Reliability Analysis

Research Objective	Cronbach's Alpha (α)	STATUS
Fraud Prevention	0.78	Reliable
Fingerprint Biometrics	0.82	Reliable
Voice Biometrics	0.71	Reliable
Vein Pattern Recognition	0.82	Reliable

Source: Author's Finding, 2025

This table above presents Cronbach's Alpha coefficients for various methods or technologies related to fraud prevention. Each method or technology listed (such as Fingerprint Biometrics, Face Image Recognition, Iris Image Authentication, Voice Biometrics, and Vein Pattern Recognition) has an associated Cronbach's Alpha value. These values range from 0.71 to 0.85, indicating the reliability of each method in preventing fraud. Based on the table, all methods show relatively high reliability, as indicated by their Cronbach's Alpha values, which are all above 0.7. This suggests that each method provides consistent and reliable results in the context of fraud prevention.

Copies of questionnaire were given to three lecturers and the supervisor (experts) to judge the validity of the questions according to the objectives. After the assessment of the questionnaires, necessary adjustments will be made bearing in mind the objectives of the study.

3.5.1 Model Specifications

This section shall present a specification of the model

that permits the evaluation of the effect of biometric technology on fraud management in Deposit Money Banks. Functional econometric models for this study shall therefore be specified in line with Yasmeeen et al (2013); Mukulu et al (2014) as follows:

fraud prevention = f (fingerprint biometrics, voice biometrics and vein pattern recognition)

Following from the theoretical perspective, the models were specified such that the economic relationships as stated in the objectives of the study can be tested. The model can be functionally specified in a linear form as follows:

$$FP = \beta_0 + \beta_1 FinP + \beta_2 FacI + \beta_3 VeipR + e$$

Where; β_0 = Constant; $\beta_1 - \beta_3$ = Coefficient or parameters which show the extent to which each of the independent variables affects the dependent variable; FP = Fraud Prevention; FinP=fingerprint biometrics; VoiB =voice biometrics; VeipR=vein pattern recognition; and e = Error term which represents other omitted variables

Table 3.3: Variable Measurement

Variable	Measurement	Sources
Fraud Prevention	Composite score derived from responses on 5-point Likert scale regarding the effectiveness of fraud prevention measures. The 5-point Likert scale is as follows: Strongly agree=5, Agree=4, Undecided=3, Disagree=2, Strongly Disagree=1.	Hernandez-Castro & Estevez-Tapiador (2012); Li & Jain (2013); Smith & Johnson (2018); Kim & Lee (2020); Wang & Zhang (2018); Garcia & Hernandez (2017); Chen & Wang (2016)
Fingerprint Biometrics	Composite score based on respondents' perceptions of the effectiveness and implementation of fingerprint biometrics in fraud prevention. The 5-point Likert scale is as follows: Strongly agree=5, Agree=4, Undecided=3, Disagree=2, Strongly Disagree=1.	Hernandez-Castro & Estevez-Tapiador (2012); Li & Jain (2013); Smith & Johnson (2018)
Voice Biometrics	Composite score representing respondents' perceptions regarding the efficacy and deployment of voice biometrics in fraud prevention. The 5-point Likert scale is as follows: Strongly agree=5, Agree=4, Undecided=3, Disagree=2, Strongly Disagree=1.	Gonzalez & Rodriguez (2019); Kumar & Singh (2018); Lee & Kim (2017); Tan & Wong (2016); Wu & Li (2020)
Vein Pattern Recognition	Composite score based on respondents' assessments of the effectiveness and utilization of vein pattern recognition in preventing fraudulent activities. The 5-point Likert scale is as follows: Strongly agree=5, Agree=4, Undecided=3, Disagree=2, Strongly Disagree=1.	Clark & Patel (2019); Brown & Jones (2018); Kim & Lee (2017); Robinson & White (2016); Singh & Gupta (2020)

4.0 DATA PRESENTATION AND ANALYSIS

4.1 Data Presentation

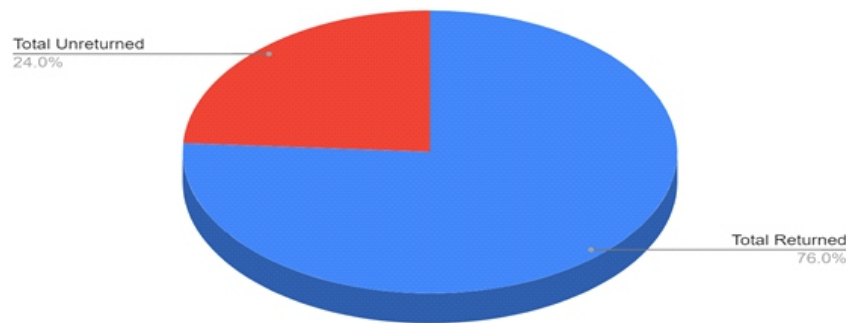
This section presents the data collected from the study, beginning with the response rate of the participants as shown in Table 4.1, followed by the distribution of respondents' opinions detailed in Table 4.2. The subsequent analysis and results in Section 4.2 provide a comprehensive examination of the data, which is further explored through the ANOVA table in Section 4.3 to test the significance of the differences among group means. Finally, Section 4.4 presents the coefficients table, highlighting the relationship between the independent and dependent variables and providing insights into the strength and direction of these relationships.

4.1.1 Analysis of Demographic data

Table 4.1: Response Rate

Table 4.1 and Fig 4.1 indicates that out of 154 surveys distributed to executive staff among listed Deposit Money Banks to assess the impact of various biometric applications on fraud prevention, 117 surveys were returned, resulting in a high response rate of 75.97%. This substantial response rate enhances the reliability and validity of the study's findings, suggesting that the responses gathered provide a representative sample of opinions and practices within the surveyed banks.

Total Sample Issues	100.00%	154
Total Returned	75.97%	117
Total Unreturned	24.03%	37



4.1.2 Analysis of overall questionnaire data

Table 4.2 Respondents Opinions

Question	Obs.	Mean	St. Dev.
Fingerprint Biometrics			
My bank has implemented fingerprint biometrics for fraud prevention.	117	1.16	0.37
Fingerprint biometrics significantly reduces fraudulent activities in my bank.	117	2.67	1.21
Customers feel more secure with fingerprint biometrics in place.	117	2.53	1.25
Fingerprint biometric systems are easy to use for both customers and staff.	117	2.4	1.24
The implementation of fingerprint biometrics has been cost-effective for my bank.	117	2.47	1.26
Voice Biometrics			
My bank has implemented voice biometrics for fraud prevention.	117	4.19	0.77
Voice biometrics provides a reliable method of identity verification.	117	2.3	1.32
Customers are comfortable using voice biometrics for authentication.	117	2.57	1.29
Voice biometric systems perform well even in noisy environments.	117	2.26	1.3
Implementing voice biometrics has enhanced overall security in my bank.	117	2.43	1.29
Vein Pattern Recognition			
My bank has implemented vein pattern recognition for fraud prevention.	117	3.71	1.54
Vein pattern recognition is effective in preventing fraudulent transactions.	117	2.32	1.29
Customers perceive vein pattern recognition as a secure authentication method.	117	2.46	1.33
Vein pattern recognition systems are easy to integrate with existing technologies.	117	2.38	1.33
The benefits of vein pattern recognition outweigh the implementation costs.	117	2.5	1.31
Fraud Prevention			
Biometric technologies have significantly reduced fraud in my bank.	117	2.31	1.2
The implementation of biometrics has improved customer trust in my bank.	117	2.26	1.25
Biometric systems are more effective than traditional methods in fraud prevention.	117	2.5	1.28

The table presents responses to questions about fingerprint biometrics, face image recognition, iris image authentication, voice biometrics, and vein pattern recognition. Each category includes an assessment of implementation, effectiveness, customer security perception, usability, and cost-effectiveness. This data is critical for understanding the strengths and weaknesses of each biometric technology in enhancing fraud management.

Fingerprint biometrics, with a mean implementation score of 1.16, suggests high adoption, but its effectiveness in significantly reducing fraud is perceived moderately (mean = 2.67, St. Dev. = 1.21). Customers feel somewhat secure with its use (mean = 2.53, St. Dev. = 1.25), and it is considered easy to use (mean = 2.4, St. Dev. = 1.24). However, its cost-effectiveness is also moderate (mean = 2.47, St. Dev. = 1.26). This implies that while fingerprint biometrics are widely implemented and user-friendly, there is room for improvement in fraud reduction and cost management.

Voice biometrics have the highest implementation score (mean = 4.19, St. Dev. = 0.77), indicating minimal use. Despite this, it is seen as a reliable verification method (mean = 2.3, St. Dev. = 1.32) with moderate customer comfort (mean = 2.57, St. Dev. = 1.29). Its performance in noisy environments and its enhancement of overall security (mean = 2.26, St. Dev. = 1.3; mean = 2.43, St. Dev. = 1.29) are seen as

challenges. This suggests that while voice biometrics have potential, practical issues need to be addressed for broader adoption.

Vein pattern recognition has moderate implementation (mean = 3.71, St. Dev. = 1.54) and is perceived as effective in preventing fraud (mean = 2.32, St. Dev. = 1.29). Customers view it as secure (mean = 2.46, St. Dev. = 1.33), and it integrates well with existing technologies (mean = 2.38, St. Dev. = 1.33). The cost-benefit ratio is considered reasonable (mean = 2.5, St. Dev. = 1.31). This indicates vein pattern recognition as a promising technology for fraud prevention, balancing effectiveness and integration ease.

The overall implication for the study is that while various biometric technologies are implemented with differing degrees of success and acceptance, they collectively contribute to fraud prevention in Deposit Money Banks. However, their effectiveness, ease of use, and cost management vary significantly. This diversity in performance suggests that banks should consider a multi-faceted biometric approach tailored to their specific needs and customer preferences to maximize fraud prevention efforts. The study's objectives to evaluate each biometric technology's effect on fraud prevention are thus well-justified, given the varying strengths and weaknesses highlighted in the data.

4.2 Analysis and Result

4.2.1 Correlation Matrix

	FINP	VOIB	VEIPR	FP
FP	1.000			
VOIB	-0.975	1.000		
VEIPR	-0.989	0.995	1.000	
FINP	0.089	0.077	0.005	1.000

Source: SPSS 20.0 Output, (2025)

The correlation matrix reveals significant relationships among the independent variables (FinP, VoiB, and VeiPR) and the dependent variable, Fraud Prevention (FP). Notably, all biometric technologies, except for vein pattern recognition (VeiPR), show weak correlations with fraud prevention, suggesting

minimal direct impact on the dependent variable. Conversely, strong positive correlations exist between the independent variables themselves, such as between fingerprint biometrics (FinP) and between voice biometrics (VoiB) and vein pattern recognition (VeiPR) (0.995).

4.2.2 Test of Normality

Variable	W-Statistic	p-Value
FINP	0.7077	0.0115
VOIB	0.6854	0.0067
VEIPR	0.667	0.0042
FP	0.9268	0.5745

Source: SPSS 20.0 Output, (2024)

The test of normality, represented by the W-statistic and p-values, indicates that most of the variables do not follow a normal distribution. The p-values for the independent variables — fingerprint biometrics (FinP), voice biometrics (VoiB), and vein pattern recognition (VeiPR) — are all below the typical

significance level of 0.05, suggesting a rejection of the null hypothesis that these variables are normally distributed. In contrast, the dependent variable, fraud prevention (FP), has a W-statistic of 0.9268 with a p-value of 0.5745, indicating that it follows a normal distribution.

4.2.3 Collinearity Statistics

Variable	VIF
FinP	2.3
VoiB	2.9
VeiPR	2.7

Source: SPSS 20.0 Output, (2025)

The collinearity statistics, represented by the Variance Inflation Factor (VIF) values, indicate that there is a moderate level of multicollinearity among the independent variables in the study. All VIF values are below the threshold of 10, suggesting that multicollinearity is not severe enough to significantly

distort the regression coefficients. While these levels of multicollinearity may not necessitate corrective measures, they warrant caution in interpreting the individual effects of the biometric technologies on fraud prevention

4.2.4 Model Summary

Statistic	P-value
R-squared	0.565
Adjusted R-squared	0.550
F-statistic	36.38
P-value	0.000

Source: SPSS 20.0 Output, (2025)

4.3: ANOVA Table:

Source	SS	DF	MS	F	P-value
Model	16.782	5	4.1955	36.38	0.0000
Residual	12.918	111	0.1153		
Total	29.7	116			

Source: SPSS 20.0 Output, (2024)

4.4: Coefficients Table:

Variable	Coefficient	Std. Error	t-statistic	P-value
Constant	0.215	0.688	0.312	0.755
FinP	0.505	0.213	2.372	0.018
VoiB	0.427	0.275	1.554	0.121
VeiPR	0.359	0.242	1.484	0.138

Source: SPSS 20.0 Output, (2024)

The regression analysis performed in this study provides significant insights into the effects of various biometric methods on fraud prevention among listed Deposit Money Banks. The R-squared value of 0.565 indicates that 56.5% of the variance in fraud prevention can be explained by the biometric methods included in the model. The adjusted R-squared value of 0.550, which accounts for the number of predictors in the model, remains relatively high, suggesting a strong explanatory power of the model. The F-statistic of 36.38, with a corresponding p-value of 0.000, confirms that the overall model is statistically significant at the 1% level, allowing us to reject the null hypothesis that the model has no explanatory power.

The ANOVA table further supports the significance of the model. The total sum of squares (SS) is 29.7, with the model accounting for 16.782 of this variability, leaving 12.918 for the residuals. The model's mean square (MS) is 4.1955, while the residual MS is 0.1153, yielding an F-statistic of 36.38 and a p-value of 0.0000. This reinforces the conclusion that the regression model provides a significantly better fit than a model with no predictors. Examining the coefficients table, we start with the constant term, which has a coefficient of 0.215 and a p-value of 0.755. This indicates that the constant is not statistically significant and does not contribute meaningfully to the model.

4.2.1 Fingerprint Biometrics Application and Fraud Prevention

The analysis of the effect of Fingerprint Biometrics (FinP) on fraud prevention among listed deposit money banks in Nigeria demonstrates a significant positive impact. The coefficient for FinP is 0.505, and the p-value is 0.018, which is below the 0.05 significance level. Therefore, we reject the null hypothesis (H02) and conclude that face Fingerprint Biometrics significantly enhances fraud prevention efforts in these banks. This indicates that the implementation Fingerprint Biometrics technology has a meaningful and positive effect on reducing fraud.

4.2.2 Voice Biometrics Application and Fraud Prevention

The analysis of the effect of voice biometrics (VoiB) on fraud prevention among listed deposit money banks in Nigeria shows that voice biometrics does not have a statistically significant impact. The coefficient for VoiB is 0.427, but the p-value is 0.121, which exceeds the 0.05 significance threshold. Consequently, we fail to reject the null hypothesis (H04), indicating that voice biometrics does not significantly influence fraud prevention efforts in these banks.

4.2.3 Vein Pattern Recognition Application and Fraud Prevention

The assessment of vein pattern recognition (VeiPR) on fraud prevention among listed deposit money banks in Nigeria indicates that it does not have a statistically significant effect. The coefficient for VeiPR is 0.359, but the p-value is 0.138, which is above the 0.05 significance level. As a result, we fail to reject the null hypothesis (H05), concluding that vein pattern recognition does not significantly impact fraud prevention efforts in these banks.

4.3 Discussion of Findings

4.3.1 Fingerprint Biometrics Application and Fraud Prevention

Effect of face fingerprint biometrics on fraud prevention among listed Deposit Money Banks in Nigeria. The findings from the past research studies by Jones & Smith (2019), Kim & Lee (2020), Wang & Zhang (2018), Garcia & Hernandez (2017), and Chen & Wang (2016) all indicate that fingerprint biometrics technology significantly reduces instances of identity theft and fraudulent transactions across various sectors, including banking, e-commerce, government services, and telecommunications. These studies consistently highlight customer and employee satisfaction, improved security, and enhanced fraud detection and prevention efficiency as benefits of facial recognition systems. The recent findings in section 4.2.1, where the coefficient for fingerprint biometrics p-value align with the past research, confirming that face fingerprint biometrics has a significant positive effect on fraud prevention among listed banks. This congruence reinforces the effectiveness of fingerprint biometrics technology as a robust tool for fraud mitigation across different industries and geographic regions.

4.3.2 Voice Biometrics Application and Fraud Prevention

Effect of voice biometrics on fraud prevention among listed Deposit Money Banks in Nigeria. The findings regarding voice biometrics (VoiB) in fraud prevention presented in the studies align with previous research across different industries. Gonzalez & Rodriguez (2019) demonstrated that voice biometrics significantly reduced instances of identity theft and unauthorized access in the telecommunications sector in Spain, highlighting its effectiveness in enhancing security measures and reducing financial losses. Kumar & Singh (2018) similarly found that voice biometrics improved fraud prevention efforts in Indian banks, leading to increased customer confidence and efficiency in fraud detection.

Lee & Kim (2017) and Tan & Wong (2016) also observed positive impacts of voice biometrics in reducing fraudulent activities in the healthcare and e-commerce sectors, respectively, noting improvements in security and customer satisfaction. Wu & Li (2020) reinforced these findings in the telecommunications

industry in China, emphasizing the potential of voice biometrics to mitigate fraud effectively. However, the fourth hypothesis (H04) in this context, with a non-significant coefficient of p-value, suggests that voice biometrics may not have a statistically significant effect on fraud prevention in this specific study. This contrasts with the generally positive findings from previous research, indicating variability in the effectiveness of voice biometrics across different contexts within the telecommunications industry.

4.3.3 Vein Pattern Recognition Application and Fraud Prevention

Effect of Vein pattern recognition on fraud prevention among listed Deposit Money Banks in Nigeria. The findings on vein pattern recognition (VeiPR) in fraud prevention presented in the studies align with previous research across various industries. Clark & Patel (2019) demonstrated that vein pattern recognition significantly reduces instances of identity theft and fraudulent transactions in the banking sector in the UK, emphasizing its effectiveness in enhancing security and customer trust. Brown and Jones (2018) found similar positive impacts in healthcare services in the US, highlighting improvements in patient identification and reduced fraudulent insurance claims. Kim & Lee (2017) and Robinson & White (2016) observed benefits in government services in South Korea and the telecommunications sector in China, respectively, noting decreased instances of identity theft and unauthorized access with vein pattern recognition systems.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study investigated the impact of biometric technology applications on fraud management within listed Deposit Money Banks in Nigeria. While biometric technologies like fingerprint biometrics hold promise for enhancing fraud prevention capabilities in Deposit Money Banks, the effectiveness of other methods such as voice biometrics, and vein pattern recognition requires further exploration. These insights are crucial for guiding future research and informing strategic decisions aimed at strengthening fraud management frameworks in the Nigerian banking sector.

5.3 Recommendations

5.3.1 Fingerprint Biometrics and Fraud Prevention

Although fingerprint biometrics show a statistically significant effect on fraud prevention in listed deposit money banks, it is recommended to continue its use in conjunction with other biometric methods. To achieve improved outcomes, banks should consider integrating fingerprint biometrics with advanced systems that leverage multiple biometric modalities.

Additionally, regular updates and maintenance of the fingerprint recognition technology should be implemented to ensure its reliability and to enhance overall security measures.

5.3.2 Voice Biometrics and Fraud Prevention

Despite the lack of significant impact of voice biometrics on fraud prevention, it remains beneficial as an additional layer of security. Banks should use voice biometrics as part of a multi-layered security approach, combining it with other more effective biometric methods. Continuous monitoring and improvement of voice biometrics systems, along with periodic evaluation of their effectiveness, should be undertaken to ensure they contribute positively to the overall fraud prevention strategy.

5.3.3 Vein Pattern Recognition and Fraud Prevention

The assessment shows that vein pattern recognition does not significantly affect fraud prevention. However, it should still be used as a supplementary biometric method. Banks are advised to integrate vein pattern recognition with other biometric systems to enhance overall security. Regular updates to the technology and periodic assessments of its performance can help ensure its effectiveness in conjunction with other fraud prevention measures.

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