EMERGING TECHNOLOGIES AND TAX ADMINISTRATION IN THE DIGITAL AGE: CURRENT PRACTICES AND PROSPECTS

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Abstract
Nigeria has implemented several digital reforms in tax administration, yet challenges such as low compliance, revenue leakages, and limited integration of advanced digital tools persist. This study explores the current use and future prospects of emerging technologies (Artificial Intelligence (AI), Big Data Analytics, and Blockchain) in the Nigerian tax administration. The study adopts an exploratory research approach based on secondary data sourced from academic publications, government reports, and tax authority documents. The findings indicate that digital platforms such as TaxPro-Max and various state e-tax systems have improved taxpayer registration, return filing, and electronic payment processes. However, the application of AI for predictive audit selection and the use of blockchain for secure data sharing remain underdeveloped. The study highlights the need for capacity building among tax officials, stronger legal frameworks for data governance, and investment in digital infrastructure. These findings underscore the importance of expanding technological integration to enhance efficiency, increase compliance, and reduce administrative bottlenecks in Nigeria's tax system.

Keywords: Artificial intelligence, big data analytics, blockchain technology, emerging technology, tax administration.
Jel Classification: M15; M49; OY4

1.0 Introduction

In Nigeria, tax administration has undergone digital reforms in recent years, including the introduction of e-filing platforms, online taxpayer registration systems, and digital payment channels (Araoye, Oladejo & Adesokan, 2025; Deshi & Ibilibor, 2025). However, despite these improvements, tax compliance and revenue performance remain below potential. For example, Nigeria's tax-to-GDP ratio stood at approximately 10.86% in 2023, one of the lowest among comparable emerging economies (National Bureau of Statistics/FIRS, 2023). Tax compliance rates remain constrained by weak monitoring, limited data integration, and inefficient enforcement mechanisms (Hassan, 2025). These challenges indicate that the deployment of digital tools has not yet translated into full operational effectiveness (Ogbaisi & Ibifunmilola, 2025).

The global shift toward Artificial Intelligence (AI), Big Data Analytics, and Blockchain provides new opportunities for strengthening tax administration in Nigeria (Folorunso & Nwankwo, 2024; Okeke). These technologies can enhance real-time data validation, detect evasion behaviours, automate taxpayer profiling, and improve transparency in cross-border transactions (Onyekachi & Ihendinihu, 2025; Aina, 2024). However, in Nigeria, the integration of these advanced technologies remains limited, partly due to

capacity constraints, infrastructural gaps, and slow policy adaptation (Onyekachi & Ihendinihu, 2025). Thus, a gap exists between available technological potential and its actual utilization in the tax administration in Nigeria.

Thus, this paper seeks to explore the current practices of emerging technologies in tax administration as well as prospects in Nigeria. To achieve this objective, the paper is organized into six sections: Section two presents the literature review; Section three outlines the research methodology; Section four presents the study's findings; Section five discusses the conclusions and policy implications; and Section six highlights the study's limitations.

2.0 Literature Review

Emerging Technology

Several definitions of emerging technology have been put forward by researchers. Some researchers perceive emerging technology as a technology that can greatly impact the society and the economy (Srinivasan, 2008). While others like Boom and Moor (2008) see emerging technology, as technology that can change the way we currently Halaweh (2013) seesemerging technology as a technological innovation that can maintain its relevance in ten to fifteen years. In this study, we define emerging technology as innovation in digital tax administration that is currently in the early stages of development, adoption, or application and has the potential to impact the way we administer taxes significantly.

Artificial intelligence is a branch of computer science that focuses on the development of machines and computer systems that can perform jobs or tasks that require human intelligence (Helm et al., 2020). These tasks may include problem-solving, reasoning, recognising patterns, learning and making decisions on data (Saghiri et al., 2022). Currently, the demand for artificial intelligence in various fields such as finance, accounting and taxation is growing daily. The increase in the use of artificial intelligence may not be far from its ability to automate complex tasks efficiently.

Another notable technological development in tax administration is big data analytics. Big data refers to a vast volume of structured, semi-structured, and unstructured data that is generated at high velocity from various sources, including but not limited to social media, mobile devices, and online transactions (Davenport & Harris, 2007). In other words, big data are datasets that are too large and complex to be processed using the traditional method of processing data (Al-Shiakhli, 2019). Big data analytics is the art of gathering, examining and analyzing large amounts of data to have an understanding of the properties (trend, patterns, and correlation) of the data. As we all know the size of data available to the tax authority is constantly increasing by the day as such, they would need big data analytics to effectively manage this data.

In modern days, transactions and record-keeping could involve multiple parties in a company who may be located in different jurisdictions or regions. As a result of location barriers, these parties may be faced with the problem of recording and sharing data with other participants (Pugna & Dutescu, 2020), this problem can be solved with the use of digital ledger technology, such as blockchain. Blockchain is a type of digital ledger technology that is used to record transactions in multiple places at the same time (Nakamoto, 2008). According to Srivastava (2023), blockchain is a system of storing and transferring data in a distributed and decentralized manner, using cryptographic methods to ensure its integrity and security. In the view of Daley (2022), blockchain is

a peer-to-peer decentralized and distributed ledger technology that makes the records of any digital asset transparent and unchangeable and works without involving any third-party intermediary.

Theoretical Framework

The adoption and utilization of emerging technologies in tax administration can be understood by examining established theories on technology acceptance and innovation diffusion. These theories provide explanatory frameworks for understanding how tax authorities, taxpayers, and other stakeholders interact with new digital tax systems.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis (1989), explains technology adoption based on two key cognitive beliefs, the Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived usefulness refers to the extent to which a user believes that a particular technology will enhance job performance, while perceived ease of use relates to the degree to which the technology is seen as free of effort.

Recent studies have confirmed the relevance of TAM in public sector digitalization. For instance, Akinboade and Shukla (2021) found that taxpayers' willingness to use e-tax platforms in African economies is significantly influenced by perceived convenience and system reliability. Similarly, Omodero (2023) highlights that tax administrators are more likely to accept digital platforms such as TaxPro-Max, e-filing, and e-payment platforms when these systems are user-friendly, reduce processing delays, and improve compliance accuracy. When users perceive digital platforms as complex, unstable, or poorly supported, resistance tends to increase despite potential efficiency gains.

Diffusion of Innovation Theory (DOI)

The Diffusion of Innovation (DOI) Theory, developed by Rogers (2003), explains the spread and adoption of innovations within social and institutional systems. The theory identifies five key (relative advantage, compatibility, complexity, trialability, and observability) innovation characteristics that influence adoption. In the context of Nigerian tax administration, the diffusion of advanced technologies such as AI-enabled audit selection, big-data analytics, and blockchain-based transaction verification is shaped by how tax agencies perceive their benefits relative to traditional systems. Studies such as Nwosu and Jack (2022) show that adoption improves when technologies align with existing legal frameworks and when tax officials can test and observe successful use cases. Conversely, poor institutional readiness, skill gaps, and infrastructural constraints slow adoption.

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), introduced by Venkatesh et al. (2003), integrates elements from prior technology adoption theories and identifies four determinants of adoption. According to them, the four determinants of technology adoption are performance expectancy, effort expectancy, social influence, and facilitating conditions. Recent empirical evidence supports the model in government digital transformation. For example, Adejumo and Oloyede (2022) found that performance expectancy strongly influences tax officers' willingness to use digital audit software, while facilitating conditions such as training, ICT infrastructure, and ongoing technical support determine long-term usage. Social influence also plays a role,

especially in public-sector environments where adoption decisions often follow institutional directives.

Current Practice of Emerging Technology in Tax Administration in Nigeria

Some of the recent technological innovations in Nigeria in terms of tax administration are the introduction of electronic tax applications (such as the FIRS tax calculator and JTB app) and e-tax platforms (such as TaxPro-Max, the Edo State Revenue Administration System (ERAS), and the River State Tax Information Management System (RIVTAMIS) to automate the administration of taxes. These innovative technologies use blockchain, artificial intelligence, and big data analytics to process information. For instance, the FIRS tax calculator is an application that enables taxpayers to compute their personal income tax liabilities. The JTB app is an application that is used for tax registration; the App can also be used to locate the nearest tax office and to obtain the contacts of various tax offices across the federation. The application can also be used by taxpayers to verify their TIN, access important tax dates, communicate with the JTB, and finally, access various tax laws in Nigeria. Another technological innovation in tax administration in Nigeria is the introduction of TaxPro-Max in 2021 because of the restriction of movement caused by the breakout of COVID-19.

TaxPro-Max is an online platform deployed by the Federal Inland Revenue Services (FIRS) to automate the process of administering taxes to the federal government in Nigeria (Chartered Institute of Taxation of Nigeria, 2022). In the same vein, states across the federation also came up with their e-tax platform to ease the process of administering taxes to them. For instance, in Edo State, taxpayers can register for taxes accruing to the state government through the Edo State Revenue Administration System (ERAS). ERAS is an innovation of the Edo State Internal Revenue Service (EIRS) that helps to automate the entire process of government revenue administration across all revenue streams in Edo State. The next subsection tries to Xray some of how these technological innovations are currently applied in tax administration in Nigeria

E-Tax Registration

E-tax registration is also known as electronic tax registration. It is the art of using electronic devices to register taxpayers in the tax net (Umenweke & Ifediora, 2016). In other words, e-tax registration is the process through which taxpayers register and obtain their Taxpayer Identification Numbers (TINs) and other relevant tax documents using electronic means. In Nigeria, both residents and non-residents can register for federal taxes through TaxPro-Max and the JTB App. Similarly, both individuals and companies can also register for tax purposes with the state government using the various state e-tax platforms (ERA, RIVTAMIS, LSIRS, and DSIRS). For a taxpayer to register all he or she needs to do is to log in to the TaxProMax or ERAS platform as the case may be, click on taxpayer registration and provide the necessary information (FIRS, n.d). These platforms are designed in a way that they can automatically cross-check the information provided by the taxpayer with their information on NIM, BVN and CAC as the case may be. Upon successful registration, the taxpayer will be issued a unique tax identification Number. The tax identification number serves as a reference point between the tax authority and the taxpayer.

E-Tax Filling

Every taxpayer is required to file tax returns without notice or demand. Electronic filing, commonly referred to as e-filing, is the process of submitting tax returns electronically using online software approved by the tax authority (Usman & Aldullahi, 2020). E-filing is a major development in tax administration in Nigeria because it has transformed the way tax returns are prepared, submitted, and processed. E-filing is an eco-friendly alternative that helps conserve resources and reduce the carbon footprint of tax administration. E-filing also saves time for both taxpayers and tax authorities (Richard & Ekhator, 2019). With the advent of e-filling, taxpayers can complete their returns at their convenience, while tax authorities can process returns more efficiently.

In Nigeria, taxpayers can file their federal taxes using TaxPro-Max, while taxes accruing to the state government can be filled out using the various state e-tax platforms. For instance, taxes accruing to the river state government can be filled using the River State Tax Information Management System (RIVTAMIS).

E-Tax Payment

E-tax payment, also known as electronic tax payment, is a digital system that enables taxpayers to remit their tax dues electronically, often through secure online platforms provided by tax authorities (Usman & Aldullahi, 2020).. E-tax payment offers numerous advantages over traditional methods of tax payment; one of the advantages is that it provides clear and traceable records of transactions, making it easier for taxpayers and tax authorities to track payment history and resolve discrepancies. It is also more convenient for taxpayers, as they can make payments from anywhere in the world (Richard & Ekhator, 2019).

In Nigeria, a taxpayer can pay their taxes through then various e-tax platforms in the country. In these platforms, there are various payment options open to the taxpayer. Taxpayers can either pay through their bank account (online banking) or generate a remita through the platform and make payment in the bank, upon successful payment the taxpayer will be issued an online tax receipt which serves as evidence of tax payment.

Issuing of E-Tax Clearance Certificate

An e-tax clearance certificate is a digital document issued by tax authorities to individuals, businesses, or organizations to certify that they have met their tax obligations. According to Richard and Ekhator, (2019) a tax clearance certificate is a document issued by a revenue authority to show that a person has paid taxes in full or that no tax is due on such profits or income. After filing returns and paying the taxes, business owners can request an electronic tax clearance certificate (e-TCC) from the comfort of their homes or offices using the TaxPro-Max e-service. Similarly, individuals and businesses can also obtain their tax clearance certificates from the various e-platforms in the state.

E-Tax Calculator

An electronic tax calculator (e-calculator) is also an innovative development in tax administration in Nigeria. A tax calculator is applications that allow businesses, individuals, and tax consultants to compute their tax liabilities efficiently and accurately (Oketa et al, 2021). Tax calculators are provided by tax preparation software, tax authorities and other third-party entities to assist taxpayers in computing their tax obligation based on the various income sources, deductions, and credits. Tax calculators

reduce the chances of tax errors and enhance tax compliance thereby could reduce tax audits. In Nigeria, tax calculators are embedded in TaxPro-Max and the various e-tax platforms of the state.

Prospect of Emerging Technology in Tax Administration In Nigeria

The prospects of emerging technology in tax administration in Nigeria are promising and will likely continue to evolve to meet the challenges and opportunities presented by the ever-changing economic and technological landscape. With the continual increase in digital transactions, global trade, and cross-border business activities in the country, the tax authorities need to rely more on emerging technologies in managing the immense amounts of data at their disposal as it is done in advanced countries of the world.

It is expected that in the future the Nigeria tax authority can leverage blockchain technology to effectively track its cross-border activities just as it is done in countries like Brazil, Argentina, Uruguay, and Paraguay. The tax authority can have a blockchain network which will enable it to create synergy with other tax authorities in neighbouring countries to effectively track their customs duty collections.

The Nigeria tax authority can also leverage artificial intelligence to identify and bring more taxpayers to the tax net. The TaxPro-Max and the various state e-platforms can be improved upon such that it can register taxpayers automatically without them opting for registration by collecting data of companies from the Corporate Affair Commission after successful registration the login details of the prospective taxpayers will be sent to them. Similarly, artificial intelligence technology such as drones can be used to identify buildings and swimming pools for tax purposes just as it is done in France. Tax authorities in Nigeria have to leverage artificial intelligence and big data analytics to detect possible cases of tax evasion as it is done in other clime. The TaxPro-Max and the various state e-platforms can be improved upon to identify high-risk taxpayers as that of America. By so doing the tax authority will have more time to focus on non-compliant taxpayers.

It is also expected that in the future natural language and machine learning processing technology can be incorporated into the TaxPro-Max and the various state e-platforms such that taxpayers can upload their audited financial statements to the platform instead of inputting figures and the information will be processed using machine learning algorithm to detect or uncover tax fraud as obtainable in countries like USA and India. It is also expected that in the future the Nigerian tax authorities will leverage more artificial intelligence and big data analytic tools to identify taxpayers who falsify their income tax deductions. This can be accomplished by installing software in the programme that can identify unusual ratios in the tax return submitted by the taxpayer.

3.0 Methodology

This study adopts an exploratory research design and the study relied primarily on secondary data. Relevant information was sourced from academic journal articles, government policy documents, tax authority publications, and reputable international reports. Key databases consulted include Google, Google Scholar, SSRN, OECD Digital Tax Database, and official websites of the Federal Inland Revenue Service (FIRS) and various State Boards of Internal Revenue.The selection of literature was guided by relevance to the research objectives, thematic alignment with emerging technologies in tax administration, and recency. Most of the reviewed publications fell

within the time frame of 2008 to 2025, covering the period of rapid global digital transformation in tax administration in Nigeria.

4.0 Findings and Discussion

Nigeria has made notable progress in adopting emerging technologies such as Artificial Intelligence, Blockchain, and Big Data Analytics within tax administration. Practical implementations include the introduction of e-tax platforms such as TaxPro-Max (FIRS), Edo State Revenue Administration System (ERAS), Lagos State e-Tax, and RIVTAMIS in Rivers State. These systems support taxpayer registration, return filing, payment processing, issuance of tax clearance certificates, and tax assessment automation.

Nigeria stands to benefit further by improving system interoperability and expanding the use of predictive analytics to identify high-risk taxpayers. There is also significant potential for blockchain to support the monitoring of cross-border trade and customs activities. Artificial intelligence can be used to identify non-compliant taxpayers and automatically onboard new taxpayers based on records from government agencies. Machine learning algorithms may be integrated to audit uploaded financial statements and detect irregularities.

5.0 Conclusion and Policy Implication

Advancements in digital technology have reshaped the landscape of tax administration globally, and Nigeria is gradually aligning with this trend. The adoption of emerging technologies such as artificial intelligence, big data analytics, e-tax platforms, and blockchain-related applications has improved the efficiency and transparency of taxpayer registration, filing, payment processing, assessment, and documentation. While progress has been made, the full potential of these technologies has not yet been realized, particularly in areas such as automated taxpayer profiling, predictive compliance analysis, and cross-border activity monitoring.

To enhance the effectiveness of digital tax administration, several policy actions are necessary. First, continuous capacity building for tax officials is vital to equip them with the technical skills required to operate and manage advanced digital systems. Second, a clear legal and regulatory framework should be established to support data sharing between government agencies while safeguarding taxpayer privacy and data security. Third, investment in digital infrastructure is needed to enable the deployment of blockchain and artificial intelligence systems on a national scale, including secure cloud storage, high-speed networks, and integrated data management platforms.

Limitation and Suggestion for Future Study

The major limitation of the study is its reliance on secondary qualitative evidence, which may restrict the empirical generalizability of its conclusions. Future research should consider empirical testing of the effectiveness of specific technologies, such as artificial intelligence-driven audit tools or blockchain-enabled transaction monitoring, in improving tax compliance and revenue outcomes. Such studies would provide deeper insights into how emerging technologies can be optimized to strengthen tax administration in Nigeria.

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