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THE INFLUENCE OF ARTIFICIAL INTELLIGENCE (AI) AND MACHINE LEARNING ON TAX AUDITS IN NIGERIA.

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Abstract

This study investigates the impact of digital technology adoption on tax audit effectiveness within the Federal Inland Revenue Service (FIRS) in Nigeria. A cross-sectional research design is employed, utilizing primary data collected through structured questionnaires distributed among FIRS staff. The sample size, determined using the Yamane formula, is 386, with respondents selected using stratified random sampling to ensure representation across various cadre levels. The data collected is analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that data analytics platforms, blockchain technology, and cloud computing significantly improve tax audits, contributing to enhanced audit accuracy, efficiency, and transparency. However, the study finds no significant impact of AI and machine learning on the effectiveness of tax audits in the Nigerian context.

Keywords: Taxation, Artificial intelligent, Economy, Tax Payer, Development

Introduction

The incorporation of digital technology into tax administration has been a disruptive global trend. In recent decades, nations worldwide have implemented many digital instruments to modernise their tax systems. This transition has been propelled by the necessity to improve efficiency, precision, and transparency in tax collecting and audits. In nations including the United States, the United Kingdom, and Australia, digital tax systems have attained significant sophistication. The U.S. Internal Revenue Service (IRS) employs the e-File system to electronically file tax returns, enhancing accuracy and expediting processing. The UK's Making Tax Digital (MTD) policy mandates that firms maintain digital records and provide quarterly updates, with the objective of streamlining tax reporting and compliance. Australia's Single Touch Payroll (STP) requires real-time payroll reporting, improving tax reporting efficiency and compliance. Digital technology is making considerable advancements even in underdeveloped markets. The iTax system in Kenya facilitates online tax filing and payment, significantly enhancing the efficiency of tax administration (Desai & Dharmapala 2009). The eFiling system in South Africa has optimised tax filings and payments, offering a more efficient and user-friendly experience for taxpayers (Ifeyinwa et al., 2023).

Nigeria's journey towards digital transformation in tax administration reflects a significant shift from traditional methods to more advanced, technology-driven processes. This evolution has been driven by the need to enhance efficiency, accuracy, and transparency in tax administration. The Federal Inland Revenue Service (FIRS) introduced the eFiling system as an initial step towards digitizing tax processes. This system allows taxpayers to file their returns electronically, reducing the need for physical submissions and streamlining the filing process. Recognizing the importance of convenience in tax compliance, FIRS has incorporated digital payment options. These include online payment gateways and mobile payment solutions, allowing taxpayers to make payments seamlessly from their devices (Ifeyinwa, et al 2023). This approach reduces delays and improves cash flow for the government. The nexus between digital technology adoption and tax audits is crucial for modernizing tax administration systems. As countries, including Nigeria, increasingly incorporate digital tools into their tax processes, the interaction between technology and tax audits becomes more significant. This integration has the potential to enhance the effectiveness and efficiency of tax audits, improve compliance rates, and reduce opportunities for fraud.

Digital technologies enable the automatic collection and storage of tax-related data (Lee & Gordon 2005) This includes electronic filing systems, online payment platforms, and integrated tax administration systems. Automation reduces manual data entry errors and ensures accurate and comprehensive data capture. Digital tools provide advanced data analytics capabilities that enable tax authorities to analyze large volumes of data quickly (Alfatah & Tobing 2019). Predictive analytics and machine learning algorithms can identify patterns, anomalies, and potential risks, allowing for more targeted and effective audits (Audu, 2016). Technology allows for risk-based auditing, where resources are focused on high-risk areas identified through data analysis (Ajibade, 2018). This approach improves the efficiency of audits by prioritizing cases with higher likelihoods of non-compliance or fraud

Digital technologies have increasingly become integral to enhancing tax audit effect (Abebe 2018) Data analytics platforms like Microsoft Power BI and Tableau enable auditors to sift through large volumes of tax data to identify trends, anomalies, and irregularities (Adelekan et al 2024) By applying statistical analysis and visualization techniques, auditors can more effectively pinpoint areas that may require further scrutiny. These platforms can be used to build predictive models that forecast potential areas of risk or non-compliance based on historical data. This proactive approach helps auditors focus on high-risk areas, improving audit efficiency and effectiveness. Data analytics enhances the accuracy of audits by providing deeper insights into financial records and trends. It enables auditors to identify and investigate discrepancies more efficiently, thereby improving the overall effectiveness of the audit process (Lanis et al 2012). AI and machine learning algorithms can automatically detect unusual patterns or outliers in financial data (Bakumenko & Elragal 2022). These technologies continuously learn and adapt to new patterns, making them highly effective in identifying potential tax evasion or fraud (Ahmed, 2024). AI and machine learning enhance audit effectiveness by improving the accuracy of anomaly detection and reducing the time required for data analysis (Ali-Nakyea, et al 2008). These technologies streamline audit procedures and support auditors in focusing on complex cases.

Blockchain technology provides a decentralized ledger that records all transactions transparently and immutably (Lipniewicz, 2017). This feature ensures that all entries are traceable and cannot be altered retroactively. Blockchain can facilitate real-time tracking of transactions and financial activities, allowing auditors to access up-to-date and accurate information during audits (Aamir et al., 2022). Blockchain technology enhances audit effectiveness by providing a secure and transparent record of transactions, which simplifies the verification process and reduces the risk of fraud. The real-time nature of blockchain ensures that auditors have access to current data, improving the reliability of audit outcomes. Cybersecurity solutions safeguard tax data from unauthorized access, breaches, and cyber-attacks (Abada & Winarsih 2021). This protection is crucial for maintaining the integrity and confidentiality of sensitive financial information. Effective cybersecurity measures ensure that tax data management practices comply

with regulatory standards, providing auditors with assurance that data has not been compromised (Craigen et al 2014). By protecting against cyber threats, cybersecurity solutions help prevent disruptions to the audit process and maintain the continuity of tax administration activities. Digital systems create detailed audit trails that track all transactions and changes to records. Automated audit trails enhance transparency and accountability, making it easier to trace discrepancies and investigate potential issues.

Moreover, electronic records are less prone to tampering and manipulation compared to physical records. Digital systems enhance the integrity and reliability of tax records, supporting accurate and transparent audit processes. Similarly, digital platforms provide tax authorities with easy access to comprehensive taxpayer information, facilitating more effective audits and ensuring that all relevant data is considered.Nigeria's tax system is many-sided and includes various forms of taxation levied by both federal and state governments. It is designed to generate revenue for the government, facilitate economic development, and ensure equitable distribution of resources. The system encompasses income taxes, corporate taxes, value-added tax (VAT), and other taxes that play critical roles in funding public services and infrastructure.

FIRS is the primary tax authority at the federal level. It is responsible for the administration, assessment, and collection of federal taxes. FIRS oversees taxes such as Company Income Tax (CIT), Petroleum Profit Tax (PPT), Value Added Tax (VAT), and other federal levies.Despite efforts to digitize tax processes, Nigeria still grapples with significant infrastructure challenges. Inconsistent internet connectivity and limited access to digital tools, particularly in rural and underserved areas, hinder the effective implementation of digital tax systems. This infrastructure gap affects the ability of both tax officials and taxpayers to fully engage with digital platforms. The integration of new digital systems with existing infrastructure often faces technical challenges. Disparities between different systems and platforms can lead to inefficiencies and errors in data processing and management. The reliance on digital systems for tax administration exposes sensitive taxpayer data to cybersecurity threats. There have been instances of data breaches and cyberattacks that jeopardize the integrity of tax records and erode public trust in digital tax systems.

However, many taxpayers and tax officials in Nigeria have limited digital literacy, which affects their ability to effectively use digital tax systems. This lack of skills can result in errors, inefficiencies, and resistance to adopting new technologies. While digital technology offers advanced data analytics capabilities, these tools are not always fully utilized in Nigerian tax audits. This underutilization limits the ability to identify and address potential risks, such as tax evasion and fraud. Without effective data analytics, risk assessment processes can be less accurate, leading to inefficient allocation of audit resources and missed opportunities to address high-risk areas. The effectiveness of tax audits is compromised by the limitations of current digital systems. Inefficient data management, ineffective risk assessment, and underutilized analytics hinder the ability to conduct thorough and accurate audits. This inefficiency can result in increased tax evasion and fraud, affecting the overall integrity of the tax system. Despite various reforms and initiatives, the impact of government policies on tax administration and compliance is often limited. There are gaps in the effective implementation and enforcement of tax policies, resulting in inadequate improvements in tax collection and compliance.

Nonetheless, despite the extensive research on the factors influencing tax audit efficacy, the results remain unclear. Alfatah & Tobing (2019) did a qualitative study investigating the influence of developing technology on auditing and taxation methods. They utilised a blend of bibliometric and content analysis to examine 154 pertinent English papers published in Scopus-indexed journals during the last 35 years. Adelekan et al. (2024) conducted an extensive evaluation of the integration of artificial intelligence (AI) and blockchain technologies into U.S. tax administration. Their findings underscore the benefits of these technologies in improving efficiency, transparency, and fraud detection.

Artificial Intelligence (AI)

Artificial Intelligence is the discipline focused on the development and engineering of intelligent devices, particularly sophisticated computer systems. The focus is on developing systems capable of executing activities that usually necessitate human intelligence, including visual perception, speech recognition, decision-making, and language translation (McCarthy 2021). McCarthy's formulation offers a robust framework for comprehending AI, encapsulating its fundamental nature and practical uses. Nonetheless, it might be augmented to incorporate references to current advancements and wider societal implications to provide a more comprehensive overview of the topic.

Artificial Intelligence is the discipline that aims to comprehend and create intelligent entities. It entails the development of robots capable of executing tasks that necessitate intelligence when performed by humans, encompassing reasoning, problem-solving, and learning (Leyira et al 2017). The concept is explicit and includes both the theoretical and practical dimensions of AI. It succinctly conveys that AI encompasses tasks typically linked to human intelligence. The definition would be enhanced by include recent breakthroughs, such as neural networks and deep learning, which have profoundly influenced the field of AI. Leyira et al. (2017) provide a comprehensive and lucid description of AI, highlighting its focus on comprehending and constructing systems that exhibit human-like intelligent behaviour. Augmenting the concept with references to modern technologies and actual applications could enhance its breadth and significance.

Artificial Intelligence is the examination of intelligent agents, defined as any device that detects its surroundings and executes activities to optimise the likelihood of successfully attaining its objectives. It includes methodologies and theories designed to replicate human-like cognition and behaviour (Abhishek, et al., 2024). The definition highlights AI as the examination of intelligent agents, which are systems or technologies that can perceive their surroundings and act depending on that observation. This embodies a fundamental principle in AI, wherein the objective is to develop systems capable of autonomous operation and decision-making. The definition highlights AI as the examination of intelligent agents, which are systems or technologies that can perceive their surroundings and act upon that perception. This embodies a fundamental principle in AI, wherein the objective is to develop systems capable of autonomous operation and decision-making. Abhishek, et al., (2024) provides a comprehensive definition of AI that highlights intelligent agents, perception, action, and the attainment of goals. It encapsulates the core of AI while allowing for additional exploration of contemporary technologies and practical implementations..

AI is a form of machine intelligence that can perform tasks that, if done by a human, would be considered to involve intelligence. This includes the ability to learn, reason, and adapt to new situations (Ajibade, 2018). The definition appropriately identifies AI as a form of machine intelligence, which distinguishes it from human intelligence and focuses on the capabilities of machines to replicate or simulate intelligent behavior. Ajibade (2018) provides a solid and concise definition of AI, focusing on its ability to perform tasks that involve human-like intelligence, such as learning, reasoning, and adapting. While the definition is clear and captures essential AI capabilities, it could be enhanced by including specific examples, contemporary technologies, and broader considerations of AI's scope and impact.

Theoretical Framework

Technology Acceptance Theory

The Technology Acceptance Theory (TAT) was proposed by Davis in 1986. This model elucidates the process by which users adopt and utilise technology. It asserts that perceived ease of use and perceived usefulness are fundamental determinants of technology adoption. Facilitates comprehension of the motivations and rationale behind tax professionals' adoption of digital technology, including data analytics platforms and artificial intelligence. The major aim of TAM was to elucidate the mechanisms underlying

technology acceptance, thereby predicting behaviour and offering a theoretical framework for the successful application of technology. The primary aim of TAM was to educate practitioners on actions they may undertake before system implementation. To achieve the theory's objectives, numerous steps were implemented (Csazar & Oster 2020). Davis initiated the formulation of the technology acceptance model by delineating the mechanisms that mediate the relationship between information system characteristics (external factors) and actual system utilisation. The model was founded on the Theory of Reasoned Action, which offered a psychological viewpoint on human conduct that was absent in the IS literature at that time.

TAM posits that technology acceptance occurs in three stages: external factors (system design features) elicit cognitive responses (perceived ease of use and perceived usefulness), which subsequently generate an affective response (attitude towards using technology/intention), ultimately affecting usage behaviour (Csazar & Oster 2020). The Technology adoption Model (TAM) is a theoretical framework in information systems that elucidates the mechanisms for promoting user adoption and utilisation of new technology (Davis, 1989). Information systems academics have extensively utilised it to tackle the difficulty of fostering acceptability of new information systems within organisations (Aamir et al., 2011). The Technology Acceptance Model identifies two critical criteria influencing user acceptance: perceived usefulness and perceived ease of use (Davis, 1989). The core idea is that the greater users believe a certain program would improve their performance, and the lesser the effort required to utilise the application, the higher the adoption rate will be. Since the model's initial development, numerous additional factors have been incorporated.

Artificial intelligence and machine learning technology can automate intricate operations, forecast tax evasion risks, and improve decision-making precision. The Technology Acceptance Theory (TAT) can be utilised to assess the impact of perceived simplicity of use and utility of artificial intelligence and machine learning on their adoption by tax authorities. The acceptability of these technologies will hinge on their ability to enhance audit outcomes and the perceived advantages they provide regarding efficiency and accuracy. Evaluating the impact of AI and machine learning necessitates examining their function in enhancing audit processes. TAT assesses tax auditors' perceptions of the value of various technologies in identifying hazards and automating mundane operations, therefore improving the overall efficacy of tax audits. Blockchain technology provides transparent and immutable record-keeping, enhancing the precision and dependability of financial data. The adoption of blockchain in tax audits, as per TAT, will be determined by its perceived integration simplicity and its efficacy in maintaining data integrity. Tax experts are more inclined to utilise blockchain if they perceive it as a mechanism that improves transparency and mitigates the danger of data manipulation. Examining the influence of blockchain technology entails assessing its effects on audit reliability and data integrity. TAT can assess whether the perceived advantages of blockchain in providing reliable and immutable records result in increased adoption rates among tax professionals and enhanced audit outcomes.

Cybersecurity solutions are essential for safeguarding sensitive tax information from unauthorised access and cyber attacks. The Technology Acceptance Theory (TAT) can be utilised to analyse how the perceived simplicity of implementation and the utility of cybersecurity measures affect their adoption. Robust cybersecurity is vital for preserving the confidentiality and integrity of audit data, which is crucial for audit efficacy. Evaluating the impact of cybersecurity solutions entails analysing their function in protecting audit data and guaranteeing secure audit procedures. TAT assesses tax professionals' perceptions of cybersecurity solutions as vital for data protection and examines how usability and perceived advantages influence their implementation and efficacy in audits.

Unified Theory of Acceptance use of technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was formulated by Venkatesh, Morris, Davis, and Davis in 2003 as a synthesis of many pre-existing technology acceptance theories. It

is intended to offer a thorough framework for comprehending user intentions regarding the use of information systems and the ensuing usage behaviour. The UTAUT integrates essential characteristics from earlier models to establish a cohesive framework for examining technology adoption. This approach is especially pertinent for analysing the influence of digital technologies on tax audit methods in Nigeria, encompassing tools such as data analytics platforms, Artificial Intelligence (AI), blockchain, cybersecurity solutions, and cloud computing platforms.

The UTAUT model has been examined, analysed, and applied in numerous research studies across various technologies and usage contexts since its inception, with the volume of study on this model escalating significantly. This section provides a comprehensive review of several of these studies. Abada and Winarsih (2021) utilised the UTAUT model to examine the principal factors influencing Internet banking uptake in Jordan. They examined the applicability of the UTAUT framework to Internet banking technologies. The researchers developed a survey questionnaire and sent it to 940 consumers via three banks in Jordan. The ANOVA test revealed that performance expectancy, effort expectancy, and social influence significantly impact behavioural intention. These constructs accounted for the variance in predicting the desire to adopt Internet banking. The authors discovered that gender influences the relationship between the three aforementioned components and behavioural intention. Badertscher et al. (2013) conducted a UTAUT application to examine perceptions on the utilisation of mobile services. The researchers conducted their study on 243 persons in northern Finland to examine their utilisation of mobile services and technology.

The findings indicated that an enhancement in users' skills will lead to a more favourable perception of mobile services and will elevate the intention to persist in usage. The researchers discovered that the duration of gadget usage does not influence consumers' usage intentions, although familiarity with the devices and proficiency in their use do have an effect. Curtis et al. (2010) employed the UTAUT model to analyse social media adoption among 409 non-profit organisations in the United States. This was the inaugural application of UTAUT to evaluate social media in public relations. They stated that social media platforms are becoming advantageous for communication among public relations professionals in the non-profit sector. Their findings indicated that the capacity to embrace social media is rising among organisations with public relations departments. Moreover, it was shown that men exhibited greater confidence in utilising social media, whilst women perceived social media as advantageous. Im, Hong, and Kang (2011) conducted an analysis of the interrelations among UTAUT dimensions to investigate the impact of culture on the model's components. Their research was conducted on two samples from the United States and Korea, focussing on MP3 player and Internet banking technology. Their hypotheses were evaluated using data gathered from undergraduate and graduate students from both nations. A confirmatory factor analysis (CFA) was performed to assess the statistical validity of the constructs, while employing structural equation modelling (SEM) to evaluate the fit indices for the overall model. Their findings indicated that UTAUT was the most suitable technology acceptance theory for their research.

The researchers discovered through their empirical investigation that the comparison between the two countries indicated that the U.S. sample had stronger impacts of effort expectancy on behavioural intention and of behavioural intention on usage behaviour than the Korean sample. The study by Ali-Nakyea et al. (2008) investigates internet banking adoption in Jordan through the UTAUT paradigm, specifically within the framework of mobile banking. They incorporated aspects into the model, including security, design difficulties, and reliability, as predictors of behavioural intention. Their model was influenced solely by a single moderator, which was the degree of schooling. Their observations indicated that effort expectancy had a negligible impact on behavioural intention. Utilising PLS path modelling and the Varimax technique, they discovered that both experience and education levels influence the relationship between performance expectancy and behavioural intention, as well as the connection between supportive conditions and usage behaviour.

Resource-Based Theory

The resource-based theory was proposed by Pfeffer and Salancik in 1977. Resources are characterised as assets, capabilities, organisational processes, firm traits, information, and knowledge that a corporation possesses and utilises to formulate and execute strategies. Resources can be categorised as tangible assets (physical entities such as machinery and buildings) and intangible assets (including brand reputation, intellectual property, and technological skill). The Resource-Based View (RBV) is a significant theoretical framework in organisational studies that elucidates how organisations rely on external resources and how these dependencies affect their behaviour and decision-making processes. Proposed by Pfeffer and Salancik in the 1970s, Resource Dependence Theory (RDT) asserts that organisations, especially publicly traded industrial enterprises in Nigeria, are not autonomous entities but depend on external resources for their survival, growth, and attainment of objectives. These resources may encompass financial capital, raw materials, technology, expertise, skilled labour, and social and political backing. The Resource-Based View posits that an organization's dependence on external resources influences its conduct and strategic decisions, including financial reporting disclosures. Resource-based theory posits that an organization's resources and capabilities originate from diverse sources (Grant, 1991; Bruce, 2007). The five stages of a resource-based strategy analysis include: identifying the company's resources, classifying them according to their strengths and weaknesses, assessing the company's capabilities, evaluating the profit potential of each resource and capability, selecting the optimal strategy, and identifying areas of resource deficiency (Grant, 1991).

The resource dependence hypothesis emphasises the board of directors' responsibility in establishing relationships with external entities or the larger company ecosystem to obtain access to various essential resources (Bryman & Bell 2003). The main objective of this concept is to emphasise the organisation as an open system, highlighting the interdependent link between management and external entities. The results of a company's efforts are significantly affected by the interrelation of its resources and the sustained continuity of its operations (Daily et al., 2003). This idea posits that a firm's resources and capabilities are essential for attaining competitive advantage and superior performance.

The Resource-Based Theory is pertinent for analysing the influence of digital technology on tax audits, as it underscores the utilisation of internal resources and skills to attain competitive advantage. The implementation of data analytics platforms necessitates that companies possess advanced technology and proficient individuals adept at analysing intricate data. Through the proficient application of data analytics, tax authorities can augment their audit procedures, enhance precision, and discern patterns that may signify fraud or inefficiency. A tax authority with exclusive access to advanced data analytics tools and specialised skills in their application can get a competitive advantage over others. Implementing artificial intelligence necessitates substantial investment in technology and experience. Companies must cultivate or obtain competencies to seamlessly incorporate AI into their auditing procedures. Artificial Intelligence can automate repetitive operations, analyse extensive databases, and deliver insights that enhance decision-making in tax audits. This capacity can improve audit efficiency and effectiveness. A company possessing sophisticated AI systems and proficiency in employing AI for tax audits can secure a sustained competitive advantage if its technology and methodologies are challenging for rivals to imitate.

Blockchain necessitates technology infrastructure and knowledge for its implementation. Organisations must cultivate competencies to leverage blockchain for secure and transparent record-keeping. Blockchain provides immutable data and improves transparency, which is advantageous for auditing purposes. The effective application of blockchain technology can enhance the credibility and dependability of audit outcomes. Companies that implement early and efficient blockchain technologies might achieve a competitive advantage by offering enhanced security and transparency in their auditing procedures. Robust cybersecurity measures necessitate advanced technology and proficient individuals to safeguard critical audit information. Companies must allocate resources towards comprehensive security protocols

and ongoing surveillance. Robust cyber security may avert data breaches and safeguard the integrity of audit processes, resulting in increased trust and dependability in audit results.

Organizations proficient in cyber security and adept at data protection can attain a lasting advantage by mitigating hazards that may jeopardise audit quality. Cloud computing necessitates investment in cloud infrastructure and the cultivation of competencies to effectively manage and utilise cloud-based resources. Cloud platforms provide scalability, flexibility, and remote access, hence improving the efficiency and responsiveness of audit operations. The capacity to utilise cloud computing for data storage and processing can yield considerable benefits. Companies with proficient cloud plans and capabilities can sustain a competitive advantage by providing resilient and scalable audit solutions.

Applying Resource-Based Theory to tax audit effectiveness involves examining how the integration of digital technologies leverages the firm's internal resources and capabilities to improve audit processes. The theory highlights the importance of:

i. Investing in Technology: Firms must allocate resources to acquire and implement advanced technologies that align with their strategic goals.

ii. Developing Capabilities: Successful adoption of digital technologies requires building capabilities, such as technical expertise and process integration skills.

iii. Achieving Competitive Advantage: By effectively utilizing resources and capabilities, firms can enhance their audit processes, improve accuracy, and achieve better outcomes compared to competitors.

While Resource-Based Theory provides valuable insights, it also has limitations and criticisms:

i. Overemphasis on Internal Resources: RBT may overlook the importance of external factors and industry dynamics that also influence competitive advantage.

ii. Resource Heterogeneity: The theory assumes that resources are not perfectly mobile or homogeneous, which may not always be the case in practice.

iii. Dynamic Capabilities: RBT may not fully address the need for firms to adapt and evolve their resources and capabilities in response to changing environments and technologies.

Research Methodology

This section outlines the research methodology employed in this study, focusing on the analyzing the influence of artificial intelligence (ai) and machine learning on tax audits in Nigeria, with a specific emphasis on the Federal Inland Revenue Service (FIRS). It details the research design, data collection methods, respondent sampling, procedural steps, limitations, and ethical considerations. The methodology aims to ensure that the study is systematic, reliable, and valid, providing insights into how digital technologies impact tax audit practices. A cross-sectional research design was used for this study. This approach is chosen because it allows for the collection of data at a single point in time to examine the current state of digital technology adoption and its impact on tax audit effectiveness. The cross-sectional design is particularly suited to the study's objectives as it provides a snapshot of the relationships between variables without requiring long-term data collection or longitudinal tracking.

The cross-sectional design is less complex and time-consuming compared to longitudinal studies. Since the study aims to understand the current impact of digital technologies on tax audits, collecting data at a

single point in time is sufficient for addressing the research objectives. This design allows for efficient data collection and analysis, making it feasible to gather and process responses from a significant number of respondents within a limited timeframe. This study employed the use of primary data to determine the effect of digital technology adoption on tax audit effectiveness within the Federal Inland Revenue Service (FIRS) in Nigeria. Primary data will be collected using structured questionnaires, designed to gather measurable information on the extent to which various technologies are utilized and their perceived effectiveness in improving audit practices. The questionnaires utilize a 5-point Likert scale to quantify respondents' perceptions and experiences with different digital technologies.

Factor Loadings: Estimate the factor loadings for each indicator on its respective latent construct. Factor loadings represent the strength of the relationship between the indicator and the latent construct.

Convergent Validity: Assess convergent validity by examining the factor loadings, average variance extracted (AVE), and composite reliability (CR) for each latent construct. AVE should be greater than 0.5, and CR should be greater than 0.7 to demonstrate convergent validity.

Discriminant Validity: Evaluate discriminant validity by comparing the square root of AVE for each construct with the correlations between constructs. The square root of AVE for each construct should be greater than the correlations with other constructs to establish discriminant validity.

Model Fit: Evaluate the overall fit of the measurement model using goodness-of-fit indices such as standardized root mean square residual (SRMR) and chi-square test. A well-fitting measurement model indicates that the indicators adequately represent their respective constructs.

Respondent Sampling

The target population is ten thousand six hundred two (10602) staff of the Federal Island Revenue Service. The distribution of the population by cadre is as follow:

Table 1 The distribution of the Population per the cadre in FIRS

S/N	NAME OF ORGANIZATION	TOTAL STAFF
1	Directorate	595
2	Management	5298
5	Officer	4708
6	Transitional	1
	Total	10602

Source: FIRS Human Resources Department,2024

To determine the appropriate sample size for this study, the Yamane formula was used. This formula is commonly applied in research to calculate a sample size that is representative of a given population. The

formula is particularly useful for surveys and studies where a specific confidence level and margin of error are required.

The formula is given by:

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

where N is the population size

e is the margin error

1=constant

e= 0.05%

n= 10,602 /1+ 10,602 $(0.05)^2$

n= 10,602 /1+ 10,602 (0.0025)

n= 10,602 /27505

n=386

Given the large population of 10,602 staff members at the Federal Inland Revenue Service (FIRS), a systematic approach to sampling is crucial for ensuring a representative sample. Stratified random sampling is used to ensure that different sub-groups (strata) within the population are adequately represented in the sample. This technique divides the population into distinct strata based on specific characteristics (e.g., cadre levels), and then randomly selects samples from each stratum. This approach increases the precision of the sample estimates and ensures representation across all important sub-groups.

Hypothesis

Artificial intelligence (AI) and machine learning have no significant influence on the effectiveness of tax audits in Nigeria.

The results show that artificial intelligence (AI) and machine learning do not significantly influence tax audits, as evidenced by a T-statistic of 1.027 and a P-value of 0.305. Since the T-statistic is less than 1.96 and the P-value exceeds 0.05, we fail to reject H_{02}, suggesting that AI and machine learning currently have no measurable impact on tax audits in Nigeria.

Although AI and machine learning did not show significant results in this study, their potential for improving tax audits should not be dismissed. As these technologies evolve and become more accessible, their influence on tax audits could increase. In the long term, AI and machine learning could enable predictive modeling, pattern recognition, and risk-based auditing, improving the ability to detect fraud and enhance tax compliance. The current findings may simply reflect an early stage of adoption, where these technologies are not yet fully optimized for the tax audit environment.

Discussion of Findings

The findings of this study on the influence of emerging technologies on tax audits in Nigeria provide important insights that connect to both existing theories and prior studies in the field. This section explores the findings in relation to theoretical frameworks and how they align or contrast with previous research, as well as the practical implications for tax audit systems in Nigeria.

The results indicate that data analytics platforms have a significant positive impact on tax audits. This finding aligns with theoretical frameworks such as the Technology Acceptance Model (TAM), which suggests that the usefulness and ease of use of a technology directly influence its adoption and effectiveness. In this case, the data analytics platforms are seen as useful tools for improving the efficiency and accuracy of tax audits in Nigeria, demonstrating that these platforms enhance decision-making and streamline audit processes.

Prior studies, such as those by Inyada & Ayem-Fella (2021) and Kiabel & Nwokah (2009), have highlighted the benefits of data analytics in improving the accuracy and reducing errors in audits. The findings of this study reinforce these conclusions, emphasizing that the integration of data analytics is crucial for enhancing audit quality. Practical implications suggest that tax authorities in Nigeria should prioritize the adoption of data analytics platforms to improve the effectiveness and reliability of tax audits. These platforms can help audit teams process large datasets efficiently and identify inconsistencies or fraud, thereby improving tax compliance and reducing the risk of errors.

In contrast, the findings show that artificial intelligence (AI) and machine learning do not significantly influence tax audits. The findings suggest that AI and machine learning, despite their potential, have not yet made a significant impact on tax audits in Nigeria. This result aligns with the Innovation Diffusion Theory (IDT), which suggests that the adoption of new technologies is influenced by factors such as their perceived usefulness, complexity, and cost. AI and machine learning, which are perceived as complex and costly technologies, may not yet be fully integrated into Nigeria's tax audit system, thus limiting their current impact.

Prior studies by Lee and Gordon (2005) and Irefe-Esema and Akinmade (2020) have similarly pointed out that while AI and machine learning have shown promise in automating tasks and detecting patterns, their adoption in public-sector auditing is still limited. The findings in this study suggest that the infrastructure and capacity required to implement these technologies may not yet be fully developed in the Nigerian context. Practical implications indicate that although AI has the potential to enhance audit processes, its application may be more relevant in the future as tax authorities build the necessary technological infrastructure and expertise.

Conclusion

This study explored the role of emerging technologies—data analytics, artificial intelligence (AI), blockchain, cybersecurity solutions, and cloud computing platforms—in enhancing the effectiveness of tax audits in Nigeria. The results have provided valuable insights into how these technologies are currently influencing tax audits and their potential to transform the auditing process in the Nigerian tax system.

Key findings from the study include

1. Data Analytics platforms significantly improve the efficiency and effectiveness of tax audits. These platforms enable tax authorities to process large volumes of data, identify patterns, and detect anomalies, which enhances the accuracy of tax assessments and fraud detection.

2. Artificial Intelligence (AI) and Machine Learning have not yet had a significant impact on the effectiveness of tax audits in Nigeria. While these technologies have the potential to automate and optimize audit processes, their current implementation in the Nigerian tax system is still in the early stages, and there are barriers related to cost, complexity, and infrastructure.

Recommendations

Based on the findings of this study, the following recommendations are proposed to improve the effectiveness of tax audits in Nigeria:

1. Given the significant impact of data analytics on improving audit accuracy and efficiency, it is recommended that the Nigerian tax authorities prioritize the adoption of data analytics platforms. Investments in advanced data analytics tools will enable tax auditors to analyze large datasets effectively, detect anomalies, and enhance decision-making in tax assessments. Regular training and capacity building for audit staff should also be undertaken to maximize the effectiveness of these tools.
2. Although AI and machine learning did not show a significant impact in this study, these technologies have the potential to automate routine audit tasks and optimize tax assessments. The Nigerian tax authorities should invest in the development of AI and machine learning systems. A phased approach could be adopted, starting with smaller pilot projects to demonstrate their effectiveness and then scaling up once the necessary infrastructure is in place.

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