



ARTIFICIAL INTELLIGENCE, DIGITALIZATION INVESTMENT AND TAX REVENUE YIELD IN NIGERIA

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Abstract

The prevailing scenario in Nigeria's tax system reveals an intricate web of challenges such as manual processes, bureaucratic bottlenecks, and inconsistent data management which contribute to revenue leakages and tax evasion. The study evaluated the effect of disruptive technology on tax revenue yield proxy with tax collection efficiency (TCE) and tax gap ratio (TGR), while exploring the moderating effect of digitalization investment in Nigeria. Survey research design was adopted. The population comprised 14,219 tax officers of the State Internal Revenue Services (SIRS) in the six geopolitical zones in Nigeria in the administrative and management cadre as at 31st December, 2024. A sample of 399 staff was selected using Taro Yamane (1967) formula. Data were obtained from primary sources using a structured questionnaire administered to the respondents. The obtained data were analysed using descriptive statistics and panel corrected standard error regression. The result shows that artificial intelligence proxies; AI-Powered Chatbots has positive and significant effect on TCE, and positive but insignificant influence on TGR; AI learning algorithm also reveal positive and statistically significant effect on TCE, and positive but insignificant effect on TGR; while, AI predictive analytic presents positively and statistically significant effect on both TCE and TGR. Furthermore, digitalization investment shows positive and significant moderating effect on the link between artificial intelligence and tax revenue yield. The conclusion of the study is that the integration of artificial intelligence in tax matter is a rewarding initiative to improve tax revenue drive and generation in a developing economy. It is recommended that tax policy makers, particularly in less technology driven economies, should maximize the potential of incorporating new digital invention through artificial intelligence to enhance tax system, while prioritizing tax payer acceptance.

Keywords: artificial intelligence, digitalisation investment, tax collection, tax gap ratio, tax revenue

1. Introduction

The level of economic growth of a country depends on revenue generated and adequately channelled towards its development, and one of the key sources of such revenue is tax. Tax is a fundamental source of revenue that has statutory legislative

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obligation for the taxpayers thereby, affirming the possibility of countries harnessing the revenue source to meet up with their statutory obligations (Olorunfemi & Odewole 2025). It is however, observed that, in spite of the administrative efforts channelled towards tax revenue generation by most developed and developing countries, many countries are still faced with the challenge of tax evasion resulting to uncertain progressive tax revenue yield (Gurdal et al., 2021).

Saba and Monkam (2024) submitted that, in 2023, African's tax revenue to Gross Domestic Product (GDP) stood at 15-20%; Asia 18-20% of GDP, Latin America 20-25% of GDP, and Eastern Europe: 25-30% of GDP (Organisation for Economic Co-operation and Development, OECD, 2024). The implication of this is that government is not generating enough revenue to fund its activities and provide public goods and services, and this has led to a range of negative consequences that has reduced government spending's capabilities, and increased borrowing, thereby reducing economic growth. Just like other developed and developing countries. Nigeria as a sovereign nation also have its own fair share of the challenge of maximizing tax revenue.

Ariyo (2024) posited that, Nigeria faces the challenge of achieving optimal tax revenue yield due to inadequate tax revenue generation, poor technology and infrastructure inadequacies. It was further argued that the tax-to-GDP ratio has become significantly low with 7.3% GDP in 2023, which made Nigeria to have one of the lowest revenue-to-GDP ratios in the world, this makes the country's fiscal position vulnerable to shocks (Mpofu, 2024). The reason for the low tax income is unanimously blamed on high rate of tax evasion and avoidance by taxpayers leveraging on the deficiencies of the traditional tax collection process in Nigeria.

The mode of collection and administration of tax play significant role in determining the quality of tax revenue generation. Given this, there is urgent need to improve tax collection process in use in Nigeria to determine its rate of alignment with new information technological intervention. This is to ensure that citizens of legal age comply with tax regulations to enable government effectively provide basic facilities, and foster an atmosphere that encourages both private enterprise and individual achievement.

Basse et al. (2022) asserted that Nigeria as one of the developing countries needs not only explore avenues to build technology into its governance system. Also, to explore the creation of a wider digital ecosystem that have positive disruption to existing technology channels which can improve revenue administration to improve domestic revenue mobilisation. Additionally, it was stated that understanding the contextual environment, stakeholders and their needs, technological requirements and the envisaged outcomes as pivotal components of a digital ecosystem is important for tax administrators in developing countries.

Uzomah and Eruetemu (2024) submitted that embracing disruptive technology, tax authorities can improve efficiency, reduce tax evasion, and enhance the taxpayer experience. A major highlight of disruptive technologies is artificial intelligence. The composition of the high-grade technological advancements embedded in artificial intelligence gives it potential to revolutionize tax administration holistically (Asian Development Bank, 2020).

Investment in innovative capabilities creates the opportunity to develop new and convenient services for taxpayers, together with the ability to create new tools that will assist the revenue authority to provide proactive services. The availability of (near) real-

time data creates excellent opportunities for revenue bodies. Instead of capturing and analysing past transactions, revenue bodies can now consider how they might support tax assessment.

Artificial intelligence also offers tax authorities the opportunity to differentiate the service offering to taxpayers and other stakeholders based on the inherent risk of a transaction (OECD, 2023). The measures to digitalize the tax system of most countries, especially the developing countries, focus majorly on investing in Information Communication Technology (ICT) compliant technologies. The governments of most African countries, including Nigeria, are concerned about the extent of funds committed to digitalizing the tax system (Nwolu et al. 2024). In as much as this is laudable, the utilization capacity of the advanced technology is also observed to be a potential determinant that has capability to determine the extent to which the tax administrators can maximize the benefits of the artificial intelligence.

The developing nature of Nigeria economy and the challenge of low tax revenue outcome require the conduct of a study that will explore how the Nigerian government leverages on artificial intelligence to improve its tax revenue. This has demonstrated high potency in other sphere as it has ability to store data, transmit information using machine languages that has ability to improve on activities of human. There is the possibility that if these attributes are infused into tax administration in Nigeria, the challenges of low tax revenue may be curtailed. Apart from investing in digital technology in Nigeria tax system, the extent of digital tax of a country has the potential to influence the extent of progress made in its tax revenue drive (Mpofu, 2022).

The problems of tax authorities have undermined revenue collection to inequitable tax policies that favour certain groups or individuals that led to an uneven distribution of tax burdens, exacerbating income inequality. Limited tax base, such as, relying heavily on a few taxpayers which makes revenue yield volatile and vulnerable to economic downturn. Corruption and mismanagement of tax revenue have also led to funds being diverted for personal gain, rather than being used for public benefit. As opined by Ashafoke and Obaretin (2023), the impact of these challenges on the society can lead to a decline in tax revenue, as traditional tax bases are eroded and new tax challenges emerge.

Technology is expected to be evenly distributed, exacerbating income inequality and social unrest, as well as increased tax burden, improve economic instability, and encourage equitable tax policies, exacerbate income inequality in Nigeria. But those who are already wealthy exploit tax loopholes and avoid paying taxes altogether hindering the country's economic growth and development.

Evidence from literature revealed that, through its tax authorities, Nigerian government has put in place e-Tax platform, Automated Tax Clearance Certificate (ATCC), Taxpayer Identification Number (TIN) registration, National Tax Policy (2017), Federal Inland Revenue Service Strategic Plan (2019-2023), and Nigerian Customs Service (NCS) Modernization Program in order to enhance tax revenue yield. Despite these efforts, Nigeria tax administrators are still facing a plethora of obstacles and problems as they attempt to adjust to the new information technology (Akinwunmi, 2020; Ogunleye, 2019; Moll & Yigitbasioglu, 2019; Roblek et al., 2021).

Studies have been conducted explore the influence of new innovations, technologies, and other policies on tax revenue yield, including the impact of tax

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avoidance strategies (Adefulu et al., 2024; Adegbe et al., 2019; Adeniyi et al., 2020; Ajetumobi et al., 2022; Bamikole, 2024; Garba & Almustapha, 2024; Igwe, 2022; Idowu, 2020; Nwaze, 2024; Oluwatosin & Chiukpai, 2024; Oyedele et al., 2024). However, study is yet to be extended to exhume the implication of emerging disruptive technology, particularly artificial intelligence deployment in tax administration on tax revenue yield with focus on state revenue services in Nigeria.

Shamaya et al. (2023), affirm that implementation of the new e-tax platforms and technologies with limited digital infrastructure hinders the expected optimum efficiency, and effective utilization of the technologies, tax data vulnerability to cyber threats, and technical capacity gaps. Eberechi (2023) suggested that, there is need to evaluate how Nigeria can utilize the opportunities of artificial intelligence to improve its tax system; especially the AI-powered chatbot, AI-Learning algorithms and AI-powered predictive analytics, technology component of artificial intelligence. Thus, based on the established background, contextual problem and identified gap, the study examined the effect of artificial intelligence on tax revenue yield in Nigeria, moderated by digitalisation investment.

2. Literature Review

This section provides a review of conceptual framework, relevant concepts, and theories related to the research topic. Also, empirical studies previously carried out in this area are adequately examined and reviewed. This paved way for identification of gap the study made attempt to fill.

Conceptual Framework

Figure 1 illustrates the diagrammatical representation of the relationship between the dependent variable; tax revenue yield proxy by tax collection efficiency and tax gap ratio and independent variable; artificial intelligence proxy with AI-Powered Chatbots, AI-Learning Algorithms, AI-Powered Predictive Analytics as well as moderating variable of digitalization investment on the interaction between artificial intelligence and tax revenue yield.

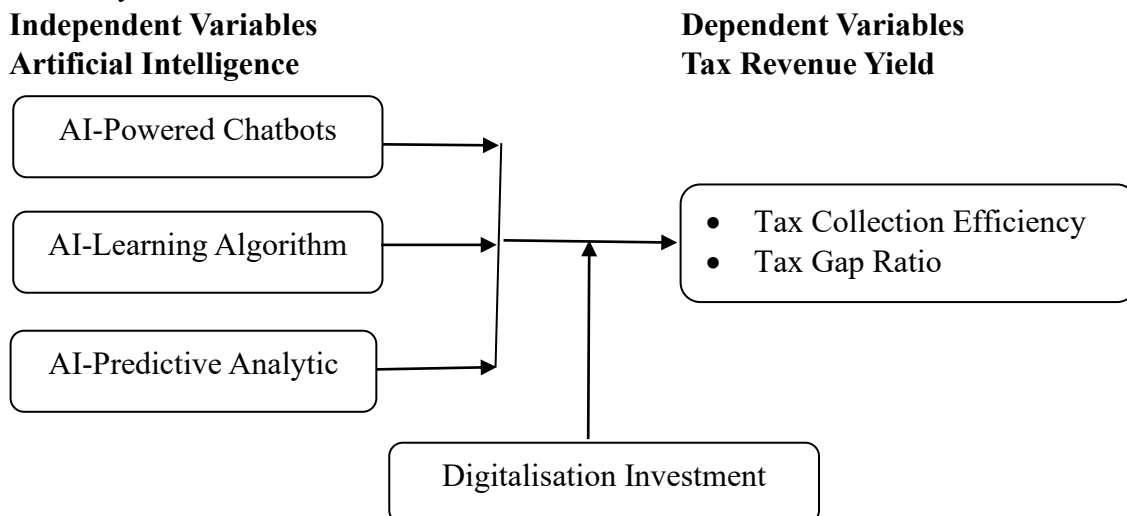


Figure 1: Conceptual model of artificial intelligence, digitalization investment and tax revenue yield in Nigeria.

Source: Authors' Design (2026)

Tax Revenue yield

Tax revenue yield in refers to the total amount of revenue generated by the government through various tax instruments, such as personal income tax, corporate income tax, value-added tax (VAT), petroleum profit tax, and customs duties. It is a critical component of government financing and reflects the efficiency and effectiveness of tax administration, the structure of the economy, and compliance levels among taxpayers Tanzi (2022).

In Nigeria, the tax-to-GDP ratio has historically been low, indicating underperformance in tax collection when compared to global averages (OECD, 2021). This has been attributed to factors such as a large informal sector, tax evasion, poor administrative capacity, and over-reliance on oil revenue (Ariyo, 1997; Nweze & Greg, 2016). Tax revenue yield measures the effectiveness of a tax system in generating revenue with two key indicators, which are Tax Collection Efficiency (TCE) and Tax Gap Ratio (TGR).

Artificial Intelligence

Artificial intelligence is the use of computer systems that can perform tasks which normally require human intelligence, to improve how government collect, forecast and manage tax revenue. According to Mpofo, (2024), Artificial intelligence (AI) is a “buzz” word, topical in advanced technology, digital transformation, economic growth and sustainable development discussions. According to Titcombe and Micah (2026), integration of Artificial Intelligence (AI) in the enforcement and assessment of taxation is a burgeoning field with significant implications for efficiency and revenue generation.

Hlomendlini (2024) suggested that, tax authorities can rely on digital technologies such as artificial intelligence to better manage taxes. Artificial intelligence offers an opportunity to reduce fraud and increase revenue, it can also improve tax compliance by facilitating the collection of authentic, accurate and complete information about traded goods and services, enhancing the ability of border agents to collect the appropriate level of trade taxes. Subsets of artificial intelligence as it is used in this study include; AI-powered chatbot, AI-Learning algorithms and AI-powered predictive analytics.

AI-powered chatbots

AI-powered chatbots are computer programs that use artificial intelligence and natural language processing to stimulate human-like conversation with taxpayers. Several factors contribute to revenue leakage, including tax evasion, tax avoidance, and inefficiencies in tax administration. AI-Powered chatbots can help curb revenue leakage in the Nigerian taxation system. AI-powered chatbots can analyse large amounts of data to identify patterns and anomalies that may indicate tax evasion or avoidance. It can also help automate tax administration processes, reducing errors and inefficiencies (Bamikole, 2024).

Hlomendlini (2024) suggested that, tax authorities can rely on digital technologies such as AI-powered education and support system in risk identifying, AI-learning algorithms and AI-powered predictive analytics to better manage taxes. AI-powered systems enhance tax compliance, reduce evasion, and improve revenue collection.

AI-Learning Algorithms

AI-algorithms in tax administration refer to the use of artificial intelligence (AI) and machine learning (ML) algorithms to improve the efficiency, effectiveness, and fairness of tax administration. The ability of these systems to analyse large datasets,

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identify patterns, and make decisions with minimal human intervention positions machine learning as an integral component in the evolution of tax systems globally.

According to Chetanpal et al (2023), Nigeria with its unique challenges in tax administration and collection, can benefit significantly from integrating AI-algorithms into its tax processes, enhancing the efficiency, accuracy, and productivity of the system. Therefore, AI-Learning Algorithms would enable tax authorities to proactively target individuals and businesses that contribute to the economy but remain outside the tax net, thus broadening the tax base and increasing revenue.

AI-Powered Predictive Analytics

AI-Powered predictive analytics is a pivotal area within Artificial Intelligence (AI) that deals with the interaction between computers and human languages. In the context of tax administration, especially in Nigeria, predictive analytics presents a transformative potential to enhance efficiency, transparency, and taxpayer engagement.

AI-Powered predictive analytics analyse large datasets and predict taxpayer behaviour, identify potential tax evasion, and optimize tax collection. By integrating natural language processes with machine learning, tax authorities can develop predictive models that anticipate trends in tax compliance and revenue generation.

Digitalization Investment

As opined by Ayodeji et al. (2023), Digitalization Investment is the allocation of resources towards implementing digital technologies to enhance tax compliance, revenue generation and overall efficiency in tax administration (Aliyu 2024). Fidelangeli et al., (2021) state that, digitalization in Nigeria is a crucial step towards increasing tax revenue yield and it also has a great impact on revenue generation.

The potentials that are associated with tax digitalization are great and should be harnessed to improve tax revenue generation. By integrating digital technologies widely, the digital economy is a transformative force that fundamentally changes economic activity. According to the World Bank, Nigeria has made some progress in its digital transformation, but strategic investments and innovations are still needed to reach its full potential (Madu 2024). To enhance this study, digitalization investment is proxy with Information Communication Technology (ICT) Investment on artificial intelligence.

Theoretical Review

Diffusion of Innovation Theory

Diffusion of innovations theory was developed by Rogers (1962), this theory explains how new ideas, technologies or practices spread through social system which helps to understand how innovative tax policies and digital solution impact tax collection. Christensen (2017) views disruptive technological improvement as an innovative destruction that modify and overhauls the entire structure of a technology. This implies that innovativeness is important at every stage of business life cycle.

This theory is unique because of its relative advantage, compatibility and complexity that brings about how well an innovation aligns with existing values, needs and experiences which enhance ease of understanding and usage of disruptive technologies. Artificial intelligence powered applications can streamline tax compliance, reduce manual data entry and improve accuracy. For instance, AI-Powered chatbots can guide taxpayers through filling process, answering questions and providing real-time support.

Empirical Review

Artificial Intelligence and Tax Revenue Yield

Ofoegbu et al. (2016) studied effects of tax revenue on economic development of Nigeria using annual time series data for the period 2005-2014. The study discovered that there was a significant relationship between tax revenue and economic development. The results also revealed that, measuring the effects of tax revenue on economic development using HDI gave lower relationship than measuring the relationship with GDP gives a painted picture of the relationship between tax revenue and economic development in Nigeria. The study only covered a 10-year period (2005-2014), which may not be sufficient to capture long-term trends and relationships also, the study used HDI and GDP as proxies for economic development, which may not capture the full complexity of economic development.

Cornelius et al. (2016) examined the impact of tax revenue on the Nigerian economy. The study covered the period from 1986 to 2010 using CIT, PPT and NOR as independent variable against GDP. Their findings revealed that, there was a significant relationship between petroleum profit tax and the growth of the Nigeria economy. It also showed that, there was a significant relationship between non-oil revenue and the growth of the Nigeria economy. They found that, there was no significant relationship between company income tax and the growth of the Nigeria economy. However, the study used GDP as a proxy for economic growth, which may not capture the full complexity of economic development.

Leipzig and Dodev (2016) examined the relationship between innovation and tax revenue for companies listed on the New York Securities Exchange (NYSE) in USA for the six years period between 2009 and 2015. Using panel data analysis, the study found evidence that there is a positive and significant relationship between innovation and revenue for the firms listed on the NYSE. The study established that innovation has explanatory power on revenue.

On the contrary, Adeniyi and Kehinde (2017), in their article, highlighted the issue of tax evasion and non-compliance in Nigeria, emphasizing the need for advanced technology in improving tax collection. The study emphasized the extent to which electronic taxation has curbed tax evasion in Lagos State. Survey research design was used in the study. The population of the study is defined as business owners and financial analysts. Analysis of variance (ANOVA) were used to analyse data collected on tax evasion and electronic tax system. The test show that electronic tax system has enhanced better management of tax payers' data, therefore minimize the incidence of tax evasion among taxpayers.

Ayeni et al. (2017), investigated the tax revenue and Nigerian economic growth for period of three decades, using time series data from 1986 to 2015. The study examined the significant difference between the effects of oil and non-oil tax revenue on economic growth in Nigeria. Data was collected from Central Bank of Nigeria (CBN) Statistical Bulletin and National Bureau of Statistics (NBS). The study utilized both descriptive and Paired Sample T-test. Findings showed that, oil and non-oil tax revenue were positive and strongly correlated with Real Gross Domestic Product (RGDP).

Gupta (2017) investigated determinants of tax revenue effort in a set of developing countries over the period of 25 years. He concluded that several structural factors like per capita GDP, share of agriculture in GDP and trade openness are

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statistically significant and strong determinants of revenue performance. The result indicated that although foreign aid improved revenue performance significantly, debt did not. Among the institutional factors, corruption had significantly negative effect on revenue performance.

The study is in line with Gupta (2022) which explored the adoption of AI in tax administration in India. These studies demonstrated the potential benefits of AI in improving tax collection efficiency and reducing corruption, which can be relevant to the Nigerian context. They also identified challenges related to AI adoption, including data security, ethical concerns, and the need for skilled personnel. However, they primarily focus on international experiences and do not delve into the Nigerian context.

Oyelere et al. (2019) examined the feasibility of using machine learning algorithms for fraud detection in tax returns. They found that AI-based models improved the accuracy of identifying tax evasion cases. Similarly, Olaniyan and Asaolu (2018) discussed the challenges faced by tax authorities in Nigeria and suggested that AI can help streamline the tax assessment process, reducing the tax gap. These reviews failed to capture stakeholders' perspectives or even provide an economic assessment consisting of benefits or drawbacks of using AI in Nigeria.

Vamsikrishna (2019) conducted a study on reviews of contemporary business analytics to provide valuable insights. The study examined the impact of artificial intelligence on the revenue growth of small businesses in developing countries. The study found that AI applications in areas like customer service, marketing, sales forecasting, inventory management, financial planning, and lead generation have a statistically significant impact on revenue growth. However, AI-based employee management and cybersecurity did not show significant effects. While this study focuses on small businesses in developing countries, its findings suggest that AI can have a positive impact on revenue growth. This implies that AI could potentially increase tax revenue yield, as businesses with higher revenue growth may pay more taxes.

Huang and Rustad (2019) in their journal article, examined the legal and ethical aspects of AI in tax enforcement, discussing issues related to privacy, data protection, and fairness. The study highlighted the need for robust regulatory frameworks to ensure responsible AI use in taxation. On the contrary, Joseph and Falana (2021), investigated the connection between artificial intelligence (AI) and firm performance. The study employed survey research design using triangulation method for data collection, population of the study consisted all companies in Nigeria. The data were analysed using descriptive and inferential statistics using Pearson correlation matrix test and analysis of Variance (ANOVA). The study showed how firms that adopted AI solutions such as robotic taxation experienced enhanced bottom-line performance, besides, the study also revealed that robotic involvement led to an increase in employment of skilled workers. The study concluded that AI has a positive incidence on firm performance.

Kifordu (2021) investigated the impact of Machine Learning (ML) in tax administration with a special focus on Nigeria. The research problem highlighted the challenges being faced in the current system as a result of poor data management methods. The study proceeds to examine how the use of ML methods can help to solve the issues raised. Case study methodology was adopted as appropriate and data collection were interviews and systematic review. The results obtained show that the stakeholders in

the company tax administration process both want improvements in the tax system through greater use of data.

Holtzblatt and Engler (2022) analysed the use of AI in the United States Internal Revenue Service, showcasing how AI has improved tax compliance, fraud detection, and customer service. The study agreed with Googin and Ellis (2020), in their research emphasized that advanced computerized data processing has been used in Brazil and Singapore to aid in contact tracing as part of the COVID-19 pandemic response. The study finds out that these automated systems save time, reduce human capital costs, free up personnel to work on other tasks, curb biases and discrimination, and enable the consideration of problems too complex for human analysts.

Also, Ayodeji, et al (2023) investigated effect of disruptive technology (DT) on return on investment of selected manufacturing SMEs in Lagos and Ogun States, South-West, Nigeria. The study adopted a survey research design with population of 2603 with sample size of 436 owners-managers of manufacturing SMEs in Lagos and Ogun States, Nigeria using simple random sampling technique. Findings revealed that disruptive technology components had significant effect on return on investment. It concluded that disruptive technology improved return on investment of selected manufacturing SMEs in Lagos and Ogun States, South-West, Nigeria.

Nkwede and Aniuga (2023) investigated artificial intelligence: challenges and opportunities for the accounting profession in Nigeria. From the findings, accounting professional are advised to strive harder in order to beat competition by delivering quality services to her clients through harnessing opportunities for rebranding, reengineering and radically improving the business and investment decisions which is the ultimate purpose of the profession.

On the contrary, Nwaze (2024) conducted a research on Artificial Intelligence (AI) in the assessment and enforcement of tax in Nigeria, the study highlights the importance of creating a robust legal and ethical framework to guide AI implementation in taxation, The method of data collection adopted is the doctrinal method, using analytical approach, findings suggest that AI has the potential to significantly improve tax collection and enforcement in Nigeria which will ultimately lead to increased revenue generation and reduction in tax evasion.

Ariyibi et al. (2024) examines the integration of artificial intelligence (AI) technologies in modern tax administration systems, focusing on their application in detecting and preventing tax fraud. The paper analyses various AI methodologies, including machine learning algorithms, deep learning networks, and natural language processing techniques, the study encompasses both theoretical frameworks and practical implementations across different jurisdictions, highlighting successful case studies and emerging challenges. The findings indicate that AI-powered systems demonstrate superior accuracy in detecting complex fraud patterns compared to traditional rule-based approaches.

Saba and Monkam (2024) examined Leveraging the potential of artificial intelligence (AI) in exploring the interplay among tax revenue, institutional quality, and economic growth in the G-7 countries from 2012 to 2022. Cross-Sectional Augmented Autoregressive Distributed Lag (CS-ARDL) technique is used to analyse the data. Based on the causality CS-ARDL results, the study finds out that G-7 governments and policymakers should prioritize and strengthen the integration of AI into their institutions

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to stimulate growth in both the short- and long-term. The study cautions against overlooking the interaction between AI and tax revenue, as it did not demonstrate support for economic growth.

Folorunso and Nwankwo (2024) examined harnessing the power of AI for taxation: Nigeria's path to improved revenue generation and transparency. The article explores the potential of AI in enhancing revenue generation and transparency in Nigeria's taxation system. The study also discusses the implementation strategies for integrating AI into Nigeria's taxation system, including data management, system integration, and change management.

Zakir et al. (2024), conducts a thorough investigation into the profound ramifications of Artificial Intelligence (AI) and Machine Learning (ML) on legal proceedings and the justice system. It assesses how these technologies are reshaping existing legal structures and principles by fundamentally altering judicial practices.

Oluwatosin and Chiukpai (2024) investigates the transformative potential of artificial intelligence (AI) and machine learning (ML) in optimizing taxation policies to support rural development and infrastructure enhancement. Methodologies include both supervised and unsupervised learning, neural networks, and regression analysis. Findings indicate that AI and ML facilitate data-driven decision-making, enabling governments to predict tax trends and assess economic conditions more effectively. Through predictive modelling, these technologies can identify tax collection inefficiencies, enhancing compliance and revenue generation. AI-driven insights assist in the strategic allocation of resources to critical infrastructure projects in rural areas, supporting sustainable development. The segmentation of taxpayers using ML techniques allows for the tailoring of tax policies to meet the diverse needs of rural communities.

Titcombe and Micah (2026) examined the relationship between artificial intelligence and tax administration in Nigeria. A quantitative research design was employed, using a structured questionnaire administered to a purposively selected sample of 552 tax administrators across three states in Nigeria. Hypotheses were tested using the Pearson Product Moment Correlation Coefficient and the multiple regression analysis technique. Results revealed that Machine Learning has a significant, moderate positive relationship with data collection, leading to the rejection of the first null hypothesis. However, its relationship with data processing was not statistically significant, resulting in acceptance of the second null hypothesis. Furthermore, Natural Language Processing showed a significant, moderate positive relationship with both data collection and data processing, leading to the rejection of the third and fourth null hypotheses. Based on these findings, the study recommends that tax authorities strategically adopt Machine Learning to automate and enhance the accuracy of data collection processes, while integrating Natural Language Processing to improve the analysis of unstructured taxpayer communications and documents.

Gaps in Literature

There is a dearth of empirical evidence on the effect of artificial intelligence on tax revenue yield in Nigeria. Thus, most of the cited studies focus on regions outside of Nigeria, such as Kenya, United States, China and Africa. A key gap is the lack of empirical evidence from Nigeria, which make it difficult to assess studies in the area of study on investigating how artificial intelligence affects tax revenue yield in Nigeria can offer insights into the subject's relevance in a developing country.

Nevertheless, all the existing literature cited tends to emphasize specific aspects, such as tax revenue and economic development, digitalization investment in tax administration, impact of artificial intelligence on the revenue growth, implications of disruptive technology on taxation aspects, feasibility of using machine learning algorithms for fraud detection in tax returns, and I-tax system capabilities and revenue collection by Kenya Revenue Authority. (Ofoegbu et al., 2016; Ayeni et al., 2017; Oyelere et al., 2019; Adeyemo, et al., 2019; Oyedele, et al., 2019; Bonsu, et al., 2023; Okafor, 2024; Achibo & Wanjohi, 2024).

In addition to the above empirical studies, there is a gap in the results of previous research on artificial intelligence, including research conducted by Dike & Worugji (2020) that explained the Nigerian government to increase taxpayer confidence in utilizing disruptive technology, but is constrained by the large cost of implementing these technology which cannot accurately measure tax revenue, that governments at all levels are now exploring new technological advancements for raising revenue and reducing the cost of governance (Sani et al., 2022).

Moreover, the perception of extant studies on theories of artificial intelligence were majorly on laffer curve theory, and technology acceptance model. These theories were adopted in literature as most of the existing studies were on digital taxation, revenue generation and economic growth which those theories were hinged. This study is hinged on diffusion of innovation theory. In summary, previous studies have revealed mixed results, some have reported positive significant effect, others reported negative effects. To the best of the researchers' knowledge, there is still dearth of studies that have considered the effect of artificial intelligence on tax revenue yield in Nigeria. In addressing this gap in literature and expanding the frontiers of knowledge in this regard, this study sought to contribute to body of knowledge by investigating the effect of artificial intelligence on tax revenue yield in Nigeria.

3. Methodology

Considering the qualitative nature of this study and the intent of the researcher to adopt information from the tax officials, the methodological assumption of this study is based on the positivism assumptions of research philosophy. This study adopts survey research design. This study utilized data from primary source. Data was collected using structured questionnaire that was administered to the staff of State Internal Revenue Service (SIRS) which formed the respondents of this study.

The population of this study consists 14,219 management and administrative staff of State Internal Revenue Services (SIRS) of the 36 states in Nigeria as at 31st December, 2024. The states comprise; Benue (2,215), Adamawa (1,560), Kano (2,102), Anambra (1,507), Rivers (2,998), and Lagos (3,837). Sample size of the study is 399 management and administrative staff of State Internal Revenue Services (SIRS) in six states. The sample size was determined using Taro Yamane (1967) sampling equation. The multistage sampling technique was used to determine the respondents which formed part of the sample size.

First, the 12 out of the 36 states were grouped into the six geopolitical zones, to comprise two states from each zone. Criterion sampling method was used to purposively group the states into one large, and one small SIRS in the zone based on the size of economic activities in the states. The Purposive sampling technique was further used to

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select one SIRS in each of the six geographical zones based on the economic size and internally generated revenue of the states; as it has influence on the size of the SIRS. The six states that was selected based on the criterion are; Benue, Adamawa, Kano, Anambra, Rivers and Lagos states respectively. The distribution of the sample size among these states was done based on the proportion of the population of the states to the overall population size.

Table 1

Determination of Sample Size

S/N	States/SIRS	Population	Sample Computation	Sample Size
1	Benue	2,215	$\frac{2,215}{14,219} \times 399$	62
2	Adamawa	1,560	$\frac{1,560}{14,219} \times 399$	44
3	Kano	2,102	$\frac{2,102}{14,219} \times 399$	59
4	Anambra	1,507	$\frac{1,507}{14,219} \times 399$	42
5	Rivers	2,998	$\frac{2,998}{14,219} \times 399$	84
6	Lagos	3,837	$\frac{3,837}{14,219} \times 399$	108
	Total	14,219		399

Source: Researcher's Computation (2026)

To evaluate the nexus between artificial intelligence and tax revenue yield in Nigeria, as well as digitalization investment serving as moderating variable, models in equation 1 and 2 were employed. The models were presented in functional forms as follow;

$TCE = f(AIPCB, AILAG, AIPRD)$; $TGR = f(AIPCB, AILAG, AIPRD)$. In econometric form, the model 1 and 2 are hereby stated thus: $TCE = \beta_0 + \beta_1 AIPCB + \beta_2 AILAG + \beta_3 AIPRD + \mu_i \dots (1)$;

$TGR = \beta_0 + \beta_1 AIPCB + \beta_2 AILAG + \beta_3 AIPRD + \mu_i \dots (2)$; Where; TCE = Tax Collection efficiency; TGR= Tax Gap Ratio; AIPCB = AI-Powered Chatbots; AILAG = AI-Learning Algorithms; AIPAD= AI-Power Predictive Analytics; β_0 , is constant; $\beta_1, \beta_2, \beta_3$ are the coefficient of the parameter estimate. The instrument was subjected to validity and reliability using composite reliability and convergent validity tests. Partial Least Square Structural Equation Modelling (PLS-SEM) was used for the inferential analysis.

4. Results and Discussions

This section consists of the presentation of data obtained through the use of questionnaire and the analysis.

Descriptive statistics

Descriptive statistics of the variables used in the study is considered appropriate as this help to showcase the summary of the respondents' opinion about tax collection efficiency, tax gap ratio, AI powered chatbots, AI powered predictive analytic and

digitalization investment. The descriptive statistics showed that the average response of respondents as tax collection efficiency (TCEF) is 2.973 which signify their agreement to efficiency in tax collection as the value is close to large extent on the Likert scale.

The standard deviation is 0.691 indicating that the responses of the respondents as regard tax collection efficiency (TCEF) highly varies considering its distance from the mean value, with the maximum value of 4 and minimum value of 2. The responses showed a positive skewed distribution having skewedness of 0.035 and the kurtosis shows the response is normally distributed as evidenced by the Jarque Berra test which shows significance to data normality.

The descriptive statistics showed that the average response of respondents as regard tax gap ratio (TXGR) is 2.965 which signify their agreement to the questions raised to a large extent. The standard deviation is 0.685 indicating that the responses of the respondents as regard tax gap ratio (TXGR) moderately varies considering its distance from the mean value. The maximum value for the variable is 4 and the minimum value is 2. The responses showed a positively skewed distribution having skewedness of 0.044 and the kurtosis -0.860 shows the response is abnormally distributed as evidenced by the Jarque Berra test which shows significance to data normality.

The mean for AI-Powered Chatbots (AIP) is 3.214 which indicate that on the average, the response is a little above the agreed scale which implies that, the respondents are of the opinion that AI powered chatbots drives tax revenue and their responses moderately varies considering the nearness of the standard deviation to the mean value. The response is negatively skewed showing the value of -0.759 and normally distributed with kurtosis value of -1.744.

Furthermore, the statistics for AI-Learning Algorithms (AIL) shows that their average responses is above large extent on the Likert scale with the value of 3.188 and standard deviation of 0.670 which indicate their responses highly varies considering its distance from the mean value, with min value of 1 and max value of 4 and it is negatively skewed having -0.723 in value. The kurtosis value is 1.221 which is normally distributed as evidenced by the Jarque berra test which shows significance to data normality.

Responses on AI-Powered Predictive Analytics (AIA) on the average is 3.257 which signify agreement to the questions raised and the response moderately varies showing standard deviation of 0.629. The minimum value of response is 1 indicating strongly disagreed with maximum of 4. The data is negatively skewed having -0.457 in value and kurtosis value is 0.307 which is normally distributed as evidenced by the Jarque Berra test which shows significance to data normality.

Validity Test

The measurement model assessment of the variables used to examine the effect of artificial intelligence on tax revenue yield are presented in Table 2 to 6.

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Table 2

Constructs Reliability and Validity for AI-Learning Algorithms

Variables	Indicators	Factor loading	Composite reliability	Average Variance Extracted	No of Items
AI-Learning Algorithms	AILAG1	0.793	0.805	0.455	5
	AILAG2	0.624			
	AILAG3	0.675			
	AILAG4	0.620			
	AILAG5	0.647			

Source: Authors' Computation (2026)

Table 3

Constructs Reliability and Validity for AI-Powered Chatbots

Variables	Indicators	Factor loading	Composite reliability	Average Variance Extracted	No of Items
AI-Powered Chatbots	AIPCB1	0.597	0.814	0.470	5
	AIPCB2	0.610			
	AIPCB3	0.731			
	AIPCB4	0.658			
	AIPCB5	0.810			

Source: Authors' Computation (2026)

Table 4

Constructs Reliability and Validity for AI-Powered Predictive Analytics

Variables	Indicators	Factor loading	Composite reliability	Average Variance Extracted	No of Items
AI-Powered Predictive Analytics	AIPRD1	0.738	0.808	0.460	5
	AIPRD2	0.634			
	AIPRD3	0.744			
	AIPRD4	0.687			
	AIPRD5	0.571			

Source: Authors' Computation (2026)

Table 5

Constructs Reliability and Validity for Tax Collection efficiency

Variables	Indicators	Factor loading	Composite reliability	Average Variance Extracted	No of Items
Tax Collection efficiency	TCEF1	0.655	0.845	0.526	4
	TCEF2	0.721			
	TCEF3	0.395			
	TCEF4	0.668			
	TCEF5	0.797			

Source: Authors' Computation (2026)

Table 6

Constructs Reliability and Validity for Tax Gap ratio

Variables	Indicators	Factor loadings	Composite reliability	Average Variance Extracted	No of Items
Tax Gap ratio	TXGR1	0.165	0.815	0.526	6
	TXGR2	0.653			
	TXGR3	0.678			
	TXGR4	0.718			
	TXGR5	0.727			
	TXGR6	0.615			
	TXGR7	0.705			

Source: Authors' Computation (2026)

The quality of the measurements and items to be employed in the analysis is assessed for reliability and validity. The reliability is assessed using the internal consistency of scale categories which was assessed using composite reliability, also known as construct reliability while the convergent validity is calculated using the average variance extracted (AVE). Iqbal and Mia (2020) define acceptable measurement thresholds as factor loading ≥ 0.50 , AVE ≥ 0.50 , and composite reliability ≥ 0.70 . These indices should be prioritised in the measurement model and they were statistically investigated using the study's survey data and the results presented in Table 2 to 6.

Discriminant Validity

This section presents the results for the discriminant validity which is obtained using Fornell-Larcker Criterion and it is calculated using the square root of AVE in each latent variable.

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Table 7

Discriminant Validity

Study Variables	AI-Learning Algorithms	AI-Powered Chatbots	AI-Powered Predictive Analytics	Tax Gap Ratio	Tax collection Efficiency
AI-Learning Algorithms	0.674				
AI-Powered Chatbots	0.669	0.686			
AI-Powered Predictive Analytics	0.548	0.559	0.678		
Tax Gap Ratio	0.286	0.283	0.331	0.690	
Tax collection Efficiency	0.433	0.491	0.349	0.451	0.725

Source: Authors' Computation (2026)

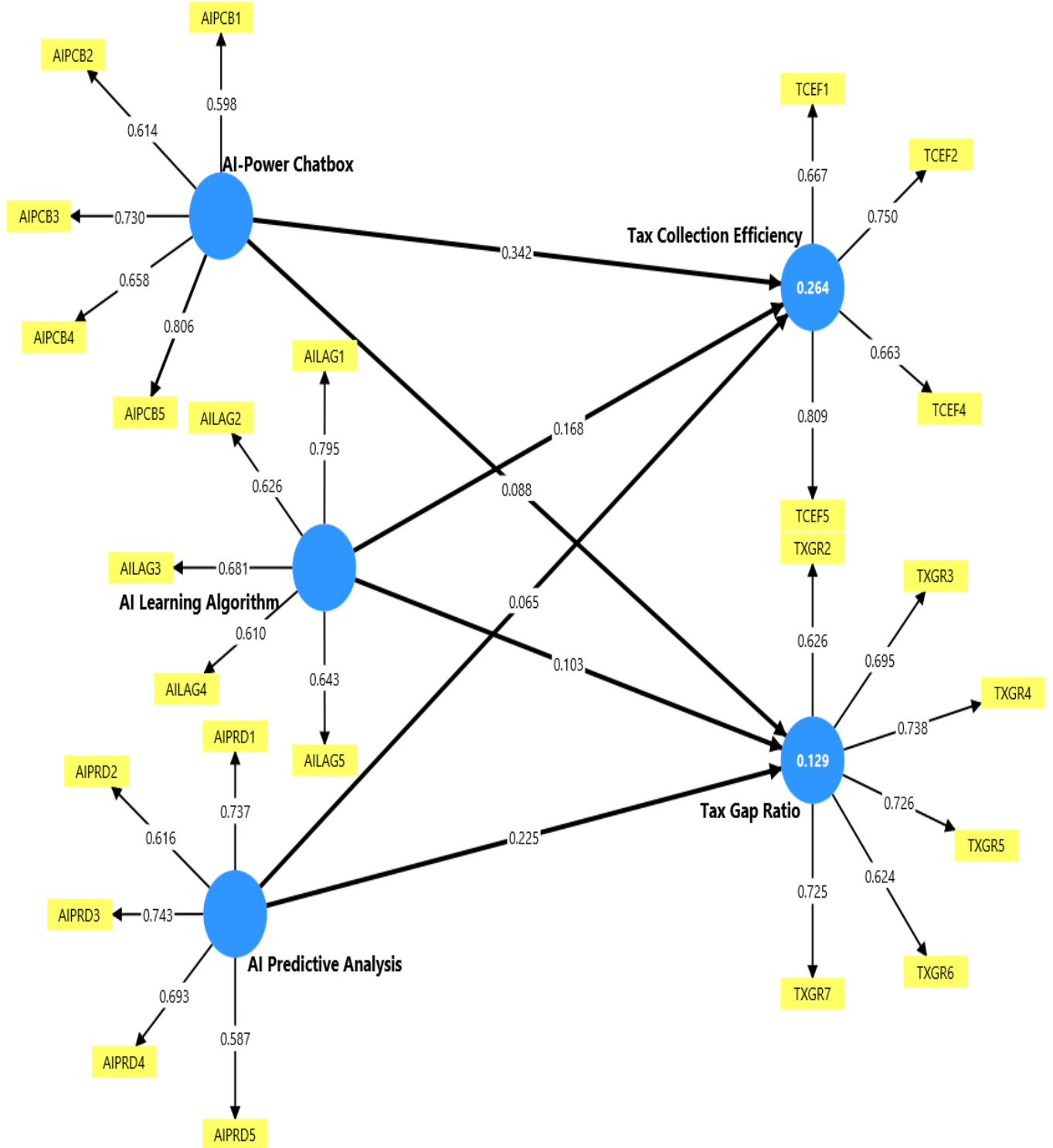
This test is important in order to validate the degree to which measures of different traits are unrelated in order to prevent multicollinearity issues. The values are expected to be higher than the correlation values among the latent variables as presented in table 4.6 that the results showed that AI learning algorithms is 0.674 which is higher than the correlation between AI-powered chatbots, AI-powered predictive analytics, tax gap ratio and tax collection efficiency.

It is also observed that for AI-powered chatbots, it is 0.686 higher than the correlation between AI-powered predictive analytics, tax gap ratio and tax collection efficiency and as for AI-powered predictive analytics, the value shows it is 0.678 higher than the relationship between the tax gap ratio and tax collection efficiency and other study variables. For tax gap ratio, it has the value of 0.690 which is higher than the correlation values for tax collection efficiency. The result presented in Table 7 validate the degree to which measures of different traits are unrelated in order to prevent multicollinearity issues.

Structural Model of the Effect of Artificial Intelligence on Tax Revenue Yield in Nigeria

The first specific objective of the study is to investigate if artificial intelligence proxy by AI-learning algorithms, AI-powered chatbots and AI-powered predictive analytics can influence tax revenue yield proxy by tax gap ratio and tax collection efficiency in Nigeria and to achieve this objective, Partial Least Square Structural Equation Modelling (PLS-SEM) was employed.

Figure 2: Partial Least Square Structural Equation Modelling Showing the Effect of Artificial Intelligence on Tax Revenue Yield in Nigeria



Source: Authors' Computation (2026)

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Table 8

Effect of Artificial Intelligence on Tax Revenue Yield in Nigeria

Constructs	Path Co-efficient	T- Statistics	P- Values
AI-Learning Algorithms -> Tax collection Efficiency	0.168	2.731	0.006
AI-Learning Algorithms -> Tax Gap Ratio	0.103	1.672	0.095
AI-Powered Chatbots -> Tax collection Efficiency	0.342	5.194	0.000
AI-Powered Chatbots -> Tax Gap Ratio	0.088	1.294	0.196
AI-Powered Predictive Analytics -> Tax collection Efficiency	0.065	0.947	0.344
AI-Powered Predictive Analytics -> Tax Gap Ratio	0.225	3.960	0.000
	R Square	R Square Adjusted	Q ²
Tax Gap Ratio	0.129	0.122	0.105
Tax Collection Efficiency	0.264	0.258	0.241
	F-Square (Tax collection Efficiency)	F-Square (Tax Gap Ratio)	Model_Fit Summary
AI-Learning Algorithms		0.006	SRMR - 0.100
AI-Powered Chatbots -	0.019	0.004	NFI - 0.538
AI-Powered Predictive	0.79	0.037	RMSE (TCEF) – 0.875
Analytic	0.004		TXGR - 0.967

Source: Authors' Computation (2026)

The path coefficient, t-statistic value, probability value and R-Square determination, effect size (f^2), the predictive relevance of the model, and the predictive relevance of the model index were the core standards for evaluating the structural model as shown in the Figures 1 and the other statistical reports are presented in subsequent tables.

The overall findings as shown in Figure 1 and Table 8 respectively indicate that tax gap ratio have 12.9 percent variance explained by measures of artificial intelligence and this can be regarded as a moderate variance. On the other hand, it is shown that tax collection efficiency has 26.4 percent variance explained by measures of artificial intelligence. The model is considered to be of good fit as the standardized root mean square residual (SRMR) have value not above 0.1 and the normed fit index (NFI) close to 1 (Hensele *at al.*, 2014; Lohmoller, 1989).

The contribution of each attribute to the R-square was indicated by the effect size (F-Square) and it is observed that AI-powered predictive analytic have the weakest magnitude having value of 0.004 which is below 0.1 recommended by Cohen (1988) and the implication is that if other exogenous variable is held constant while AI-powered predictive analytic is removed, r-square for tax collection efficiency will vary by 0.4 percent. It is however observed that if other exogenous variables are held constant while

AI-learning algorithms is removed, it will cause r-square to vary by 1.9 percent which can referred to as a low magnitude of influence. However, for AI powered chatbots, with the f-effect of 79 percent of variation in r-square of tax collection efficiency if removed from the equation while the other observed variables are held constant.

Considering the contribution of each measure to the R-square that determines Tax gap ratio, it is shown that AI powered chatbots has the weakest magnitude having value of 0.004 which is below 0.1 recommended by Cohen (1988) and the implication is that if other exogenous variable is held constant while AI-powered chatbots is removed, r-square for tax gap ratio will vary by 0.4 percent. It is however observed that if other exogenous variables are held constant while AI-learning algorithms is removed, it will cause r-square to vary by 0.6 percent which can referred to as a low magnitude of influence. More so for AI predictive analytic, with the f-effect of 0.037, it implies that if other variables are held constant when AI predictive analytic is removed, it will cause 3.7 percent of variation in r-square of tax gap ratio.

Considering the predictive relevance of each exogenous variable in the model as indicated by Q^2 shows that the model has predictive relevance since the value is greater than 0 and the implication is that one unit of improvement in artificial intelligence will improve tax collection efficiency by 24.1 percent and tax gap ratio by 10.5 percent which can be considered as substantive.

From Table 8 The P-value of the constructs indicates in Figure 1 shows a significant influence in the analysis as some of them has p-value is less than ≤ 0.05 . It was observed that an AI learning algorithm (AILG) has positive and significant influence on tax collection efficiency showing path coefficient of 0.168; t-statistics of 2.731 and P-value of 0.006. The same positive effect is recorded for the effect of AI learning algorithm (AILG) on Tax gap ratio. However, the effect is not significant and this is evidenced by path coefficient of 0.103; t-statistics of 1.672 and P-value of 0.095. This result indicates that AI learning algorithms have facilitated a reduction in tax administration expenses by reminding taxpayers of filing and payment deadlines through AI-powered chatbots, while simultaneously doing tax computations and ensuring the accurate completion of returns by taxpayers. This has led to increased compliance rates and a more efficient tax collection process.

AI powered chatbots (AIPC) has positive and significant influence on tax collection efficiency showing path coefficient of 0.342; t-statistics of 5.194 and P-value of 0.000. The same positive effect is recorded for the effect of AI powered chatbots (AIPC) on Tax gap ratio. However, the effect is not significant and this is evidenced by path coefficient of 0.088; t-statistics of 1.294 and P-value of 0.196. The implication is that AI-powered chatbots have improved taxpayers' comprehension of tax information, making tax services more accessible. Its benefits are more pronounced through its ability to address handling tax-related queries in revenue service. This enhancement has significantly reduced the burden on tax professionals, allowing them to focus on more complex issues that will drive revenue while ensuring that taxpayers receive timely and accurate information. As a result, individuals are better equipped to navigate their tax obligations and make informed decisions.

AI predictive analytic (AIPD) has positive but insignificant influence on tax collection efficiency showing path coefficient of 0.065; t-statistics of 0.947 and P-value of 0.344. The same positive effect is recorded for the effect of AI predictive analytic

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(AIPD) on Tax gap ratio and the effect is significant and this is evidenced by path coefficient of 0.225; t-statistics of 3.960 and P-value of 0.000. This implies that AI-driven predictive analytics guarantees the precision and reliability of taxpayer data, enabling taxpayers to obtain assistance with tax issues at their leisure and at any time. This innovative approach not only streamlines the process of resolving tax-related queries but also empowers tax-payers to make informed decisions regarding their tax planning.

In conclusion, it is evident that the path coefficients were of practical importance to determine if the null hypothesis should be rejected. However, the construct turned out to have p-value less than 5 percent, the null hypothesis that artificial intelligence has no significant effect on tax revenue yield in Nigeria is hereby rejected. The findings of the study align with the result of Nwolu et al (2024) which submitted that Nigeria's tax revenue is impacted by digital technologies suggesting that capital gain tax can easily be accrued through technology as they have a big influence on the nation's ability to generate revenue.

Similarly, Oyelere et al. (2019) found out that machine learning algorithms can enhance tax fraud identification and expedite tax assessment procedures in Nigeria. Equally, Vamsikrishna (2019) in a study found that AI applications in customer service, marketing, revenue forecasting, financial planning and lead generation significantly impact tax revenue in developing countries.

5. Conclusion and Recommendations

This study examined the effect of artificial intelligence on tax revenue yield with moderating effect of digitalization investment. The focus of the study consists of tax collection efficiency (TCEF), tax gap ratio (TXGR), AI-Powered Chatbots (AIP), AI-Learning Algorithms (AIL) and AI-Powered Predictive Analytics (AIA). The estimate showed that AI learning algorithm (AILG) had a positive and significant effect on tax collection efficiency (TCEF); while it also showed a positive sign with tax gap ratio (TXGR) but insignificant at 5% conventional level. The implication is that AI learning algorithms have facilitated a reduction in tax administration expenses by reminding taxpayers of filing and payment deadlines through AI-powered chatbots, while simultaneously doing tax computations and ensuring the accurate completion of returns by taxpayers.

Also, AI powered chatbots (AIPC) showed a direct and significant link with tax collection efficiency (TCEF); whereas it showed a direct link with Tax gap ratio and non-significant. Implying that AI-powered chatbots have improved taxpayers' comprehension of tax information through accessibility to tax services. Furthermore, AI predictive analytic (AIPD) showed a direct link with tax collection efficiency and non-significant; while, it was positive and significantly related to tax gap ratio. Suggesting that AI-driven predictive analytics guarantees the precision and reliability of taxpayer data, enabling taxpayers to obtain assistance with tax issues at their leisure and at any time. The study concluded that digitalisation of Nigeria's tax system boosts tax revenue yield. The study concluded that investment in digitalisation of tax administration offer a new, more efficient solution to manual tax administration through digital tax administration, which promotes government's tax revenue via disruptive technology.

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