

AUTOMATION IN TAX COMPLIANCE: THE ROLE OF ARTIFICIAL INTELLIGENCE IN MODERNIZING TAX SYSTEMS

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Abstract

This study was required because of persistent weaknesses in tax administration in Nigeria. These weaknesses include poor revenue generation, manual processing delays, administrative inefficiency, tax evasion, and low use of modern digital tools. These problems reduce the ability of government to generate adequate revenue. They also affect economic and infrastructural development. The general objective of the study was to examine automation in tax compliance. The study also examined the role of artificial intelligence in modernising tax systems in Nigeria. The study adopted an ex post facto research design. The population of the study comprised annual records on tax administration efficiency. It also comprised records on artificial intelligence-related tax compliance indicators in Nigeria. The sample size consisted of 15 annual time-series observations. The period covered 2010 to 2024. The dependent variable was efficiency of tax administration. The explanatory variables were natural language processing, blockchain technology, and predictive analytics technologies. Secondary data were analysed using descriptive statistics. Correlation analysis was also used. Ordinary Least Squares regression was also used. The findings showed that natural language processing had a positive and significant effect on tax administration efficiency in Nigeria. Blockchain technology also had a positive and significant effect. Predictive analytics technologies also had a positive and significant effect. The study concluded that artificial intelligence plays a positive and significant role in modernising tax systems in Nigeria. The study recommended regular training for tax officials and professionals. The training should focus on the use and management of AI technologies. The study also recommended the adoption of blockchain technology. This can improve transparency, security, and integrity in tax transactions. The study further recommended the use of predictive analytics. This can reduce manual errors. It can improve tax assessment. It can also strengthen tax compliance enforcement.

Keywords: Automation, tax compliance, artificial intelligence, tax administration, Nigeria.

1.0 Introduction

Tax administration is important for public revenue mobilisation. It also supports national development. It enables government to fund infrastructure. It supports public services. It supports security, education, health care, and other development needs. In Nigeria, tax administration efficiency remains a major policy issue. The country still faces revenue leakages. It also faces weak taxpayer identification. Manual processing is still common. Tax evasion remains a problem. Data integration is weak. Real-time monitoring of taxable transactions is still limited. These issues make tax modernisation necessary. This need has become stronger due to the growth of digital economic activities.

Artificial intelligence has created new opportunities for tax administration. Artificial intelligence refers to computer systems that perform tasks linked to human intelligence. These tasks include learning, prediction, classification, language interpretation, decision support, and anomaly detection. In tax

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administration, AI can support automated taxpayer services. It can support fraud detection. It can support risk-based audit selection. It can support compliance monitoring. It can also support revenue forecasting and faster tax record processing.

The International Monetary Fund noted the relevance of AI in tax and customs administration. AI can improve risk management. It can strengthen decision-making. It can also improve service delivery. The IMF also noted concerns about ethics, data privacy, transparency, and governance (Aslett et al., 2024).

The study is timely. AI is no longer a future issue in public finance. It now affects tax administration. It affects taxpayer interaction. It affects information processing. It affects non-compliance detection. It also affects revenue prediction.

Recent evidence shows rising AI use in tax administration. Tax authorities now use AI-supported tools. They also use digital assistants. They use predictive analytics. They use automated systems. These tools improve taxpayer service. They also improve administrative efficiency. The OECD (2024) reported the use of AI-supported digital tax assistants in some tax administrations. These tools provide continuous taxpayer support. They also improve access to electronic tax services. This shows a movement away from manual tax administration. It also shows a movement toward data-driven tax administration.

In Nigeria, digital tax administration has received more empirical attention. Mas'ud, Mohammed, and Gimba (2023) studied digitalisation and subnational tax administration in Nigeria. Their findings showed that e-tax data can improve state tax administration. Nwanmaghyi and Oluwaseun (2023) studied digitalisation and tax compliance in Nigeria. Their findings showed a positive link between digital tools and tax compliance behaviour. These studies show the value of digital systems in tax administration. They also show the need for proper implementation.

Recent Nigerian studies also support digital tax reforms. Adefulu, Makinde, Akinyosoye, and Nwankwere (2024) examined electronic audit, electronic tax filing, online payment systems, and electronic reporting. Their study focused on Federal Inland Revenue Service staff in Abuja. Their findings showed positive and significant effects on revenue tax compliance. Akinyosoye, Adesoga, Makinde, and Nwankwere (2024) also studied tax digitalisation and revenue generation. Their findings showed a positive and significant effect. Online payment system had the strongest effect.

These findings show the value of digitalisation. They also show a need for more advanced systems. General digital platforms may not be enough. Intelligent systems are now needed. Such systems can process large data. They can detect patterns. They can also predict compliance risks.

Artificial intelligence provides this added capacity. Natural language processing can improve taxpayer communication. It can help tax systems understand taxpayer inquiries. It can simplify tax information. It can also improve automated assistance. Blockchain technology can improve transparency. It can improve traceability. It can improve security. It can also strengthen trust in tax transactions. Predictive analytics can help tax authorities identify high-risk taxpayers. It can support revenue forecasting. It can detect irregular patterns. It can also improve audit resource allocation.

Bankole (2025) found that AI technologies improved tax administration efficiency in Lagos State. The study examined natural language processing. It also examined blockchain technology. It examined predictive analytics. It examined machine learning. Predictive analytics had the strongest effect. Natural language processing followed. Blockchain technology also showed a significant effect.

Despite these developments, some challenges remain. Many tax administration processes in Nigeria still depend on limited systems. These systems may not fully match the speed of the digital economy. They may not fully match its complexity. They may not fully match its data intensity. Tax authorities have made progress through e-registration. They have made progress through e-filing. They have made progress through e-payment. Other digital reforms have also been introduced. Yet, taxpayer tracking remains a concern. Compliance monitoring remains a concern. Revenue leakages remain a concern. Fraud detection remains a concern. Administrative delay also remains a concern.

The problem is not only the absence of digital platforms. The issue is the level of AI application in tax administration. This concern is important. Fragmented records can weaken tax monitoring. Manual verification can slow tax administration. Such systems may reduce the ability of tax authorities to

respond to modern compliance risks.

This study is therefore motivated by a clear need. It seeks to examine the role of artificial intelligence in tax compliance automation. It also seeks to examine the role of AI in tax system modernisation in Nigeria. Existing studies have examined digitalisation. They have examined e-tax filing. They have examined online payment systems. They have also examined electronic reporting. However, fewer studies have focused on specific AI-driven technologies in Nigeria. These technologies include natural language processing, blockchain technology, and predictive analytics. This creates an empirical gap. The present study addresses this gap.

The general objective of the study is to examine automation in tax compliance. It also examines the role of artificial intelligence in modernising tax systems in Nigeria. The specific objectives are stated below. The first objective is to examine the effect of natural language processing on tax administration efficiency in Nigeria. The second objective is to determine the effect of blockchain technology on tax administration efficiency in Nigeria. The third objective is to assess the effect of predictive analytics technologies on tax administration efficiency in Nigeria. The study variables follow the stated model. Efficiency of tax administration is the dependent variable. Natural language processing is an explanatory variable. Blockchain technology is also an explanatory variable. Predictive analytics technologies also serve as an explanatory variable.

The study is significant to policymakers. It is also significant to tax authorities. It is significant to taxpayers. It is significant to researchers. It is also significant to technology developers. For policymakers, the study provides empirical guidance on AI and tax reform. It also supports revenue protection. It supports public finance management. For tax authorities, the study provides evidence on AI tools. These tools may improve taxpayer service. They may improve compliance monitoring. They may improve audit targeting. They may also improve administrative efficiency.

For taxpayers, the study may support better tax reforms. Such reforms may reduce delays. They may simplify tax processes. They may also improve transparency. For researchers, the study adds to the literature on artificial intelligence. It also adds to the literature on automation. It adds to the literature on tax compliance in developing economies.

The study covers automation in tax compliance. It also covers the role of artificial intelligence in modernising tax systems in Nigeria. The geographical scope is Nigeria. The time scope is 2010 to 2024. This period is suitable. It covers recent developments in digital taxation. It covers tax automation. It covers electronic compliance systems. It also covers the rising relevance of artificial intelligence in revenue administration.

The content scope focuses on tax administration efficiency. This is the dependent variable. The independent variables are natural language processing, blockchain technology, and predictive analytics technologies. The study uses annual time-series data from 2010 to 2024. The sample size is fifteen annual observations.

2.0 Theoretical Framework

This study is anchored on the Diffusion of Innovations Theory. Everett Rogers developed the theory in 1962. The theory explains how new ideas and technologies spread within a society. Rogers defined diffusion as the process through which an innovation moves over time within a social system.

Rogers grouped adopters into five categories. These are innovators, early adopters, early majority, late majority, and laggards. Innovators are the first users of new technology. They are usually willing to take risks. They are also open to new ideas. Early adopters accept innovations after careful consideration. They help to create wider acceptance through positive feedback. The early majority adopted innovations before most members of society. They usually require evidence that innovation works. The late majority adopts innovations after broad acceptance. Laggards are the last group to adopt innovations. Their delay may be caused by fear, doubt, or limited resources (Rogers, 2003).

The theory has been applied in studies on technology adoption. Taylor and Todd (1995) used the theory to explain technology adoption in business organisations. Their study showed that adopter

characteristics and innovation features influence adoption decisions. Agarwal and Prasad (1997) also applied the theory to software technology adoption. They identified relative advantages, compatibility, complexity, trialability, and observability as important factors in adoption.

The Diffusion of Innovations Theory is relevant to this study. It explains why tax authorities adopt artificial intelligence at different rates. Some tax authorities adopt new technologies early. Others adopt them slowly. For example, the Internal Revenue Service in the United States and Her Majesty's Revenue and Customs in the United Kingdom have adopted artificial intelligence for fraud detection and compliance verification. These institutions reflect the features of innovators and early adopters. They show how public revenue agencies can use new technologies to improve tax administration (IRS, 2021).

2. Empirical Review

The empirical framework of this study is built on recent studies on digital tax administration, artificial intelligence, and tax compliance. These studies show that technology can improve tax administration. They also show that the effect depends on data quality, staff capacity, taxpayer readiness, and institutional support.

Mas'ud, Mohammed, and Gimba (2023) examined digitalisation and subnational tax administration in Nigeria. The study focused on State Internal Revenue Services. It covered the six geopolitical zones in Nigeria. The study used qualitative interviews. It also used thematic analysis. The findings showed that e-tax systems and digital identification tools can improve taxpayer identification. The study also showed that better use of digital tax data can improve internally generated revenue at the state level. This study supports the use of digital systems in tax administration.

Ogbada, Onyedika, and Modebelu (2023) examined digitalisation and effective tax administration in Nigeria. The study adopted an ex post facto research design. It covered the period from 2010 to 2021. The study used linear regression. The findings showed that ICT had a negative and insignificant effect on tax revenue. The findings also showed that ICT had a positive and insignificant effect on tax evasion. This result suggests that digitalisation may not improve tax administration by itself. It requires proper implementation. It also requires strong enforcement capacity.

Nwanmaghyi and Oluwaseun (2023) studied digitalisation and the prospects of tax compliance in Nigeria. The study was published in the *Journal of Taxation and Economic Development*. The study showed that digitalisation has relevance for tax compliance. It also showed that tax compliance can improve when digital systems reduce administrative burden. This study supports the view that electronic tax systems can improve taxpayer behaviour.

Falana, Dakhil, Abbood, and Dagunduro (2024) examined digital tax administration and tax compliance in the Nigerian informal sector. The study focused on Southwest Nigeria. It used survey data. It also used regression analysis. The findings showed that digital tax knowledge had a positive effect on tax compliance. The findings also showed that digital payment platforms had a positive effect on compliance. This study is relevant to the present study. It shows that digital tax tools can improve compliance among informal taxpayers.

Adefulu, Makinde, Akinyosoye, and Nwankwere (2024) examined tax digitalisation and revenue tax compliance in Nigeria. The study focused on Federal Inland Revenue Service staff in Abuja. It examined electronic audit, electronic tax filing, online payment systems, and electronic reporting. The findings showed that digital tax tools had positive effects on revenue tax compliance. This study shows that tax digitalisation can support compliance when tax officials use the tools effectively.

Akinyosoye, Adesoga, Olubisi, and Nwankwere (2024) examined tax digitalisation and revenue generation in Nigeria. The study was published in the *International Journal of Accounting Research*. The findings showed that electronic audit, electronic tax filing, online payment systems, and electronic reporting influenced revenue generation. Online payment system was a major predictor. This finding supports the argument that tax digitalisation can strengthen revenue mobilisation.

Aina (2024) examined the perceptions of Nigerian tax officers and stakeholders on artificial intelligence

in tax risk management. The study focused on tax officers, taxpayers, and tax consultants. The findings showed that tax officers viewed AI as useful for audit accuracy. Tax consultants also viewed AI as useful for tax system improvement. The study also identified concerns about training, privacy, transparency, trust, and resources. This study is relevant because it shows that AI adoption requires human capacity and governance support.

Aslett, González, Hamilton, and Pecho (2024) examined analytics for compliance risk management in tax administration. The study was published by the International Monetary Fund. It showed that analytics can support taxpayer profiling. It can also support audit selection. It can improve compliance risk management. This study supports the use of predictive analytics in tax administration. It also supports the use of data-driven tax enforcement.

The OECD (2024) provided comparative evidence on tax administration across 58 jurisdictions. The report showed that tax administrations now use digital tools to improve their operations. It also showed that tax authorities are changing their service models because of technology. This evidence supports the view that modern tax administration is moving toward data-driven systems. It also supports the relevance of artificial intelligence in tax modernisation.

Bankole, Osamor, and Bamgboye (2025) examined the effect of artificial intelligence on tax administration in Lagos State. The study used a quantitative research design. It collected data from 152 respondents. The study used regression analysis. The findings showed that AI technologies improved tax administration efficiency. Predictive analytics had the strongest effect. Natural language processing came next. Blockchain technology also had a positive effect. This study is closely related to the present study because it used AI variables that are similar to the variables in this study.

Falana, Adedun, Adegboye, Oladipo, and Ogundele (2025) examined artificial intelligence adoption in tax administration. The study focused on corporate tax compliance in emerging and advanced economies. It used e-government development, e-filing adoption, and government AI readiness as key indicators. The findings showed that these indicators had positive effects on corporate tax compliance. The study also showed that institutional quality improves the effect of AI adoption. This finding supports the need for strong institutions in AI-driven tax administration.

The reviewed studies show a clear empirical pattern. Digital tax systems can improve tax administration. AI tools can also improve tax compliance. Natural language processing can improve taxpayer support. Blockchain technology can improve transparency. Predictive analytics can improve risk detection. It can also improve audit targeting.

The reviewed studies also show some limitations. Many Nigerian studies focused on general digitalisation. Fewer studies focused on specific AI technologies. Some studies used perception-based data. Some studies focused on one state or one tax authority. Some findings were also mixed. For example, some studies found positive effects. Others found insignificant effects. This shows that the effect of digital technology on tax administration is not fully settled.

The present study addresses this gap. It focuses on automation in tax compliance. It also focuses on the role of artificial intelligence in modernising tax systems in Nigeria. The dependent variable is efficiency of tax administration. The explanatory variables are natural language processing, blockchain technology, and predictive analytics technologies. The study covers 2010 to 2024. This period is suitable because it captures recent developments in tax digitalisation, tax automation, and AI-supported compliance management.

3.0 Methodology

3.1 Research Design

The study adopted an ex post facto research design. This design was suitable because the study used already existing data. The data were not manipulated by the researcher. The design also allowed the study to examine the relationship between artificial intelligence variables and tax administration efficiency in Nigeria.

The study was empirical in nature. It used annual time-series data. The period covered 2010 to 2024. This period was selected because it captures recent developments in digital taxation, tax automation, and artificial intelligence-supported compliance systems in Nigeria.

3.2 Population of the Study

The population of the study comprised annual records on tax administration efficiency and artificial intelligence-related tax compliance indicators in Nigeria. These records covered natural language processing, blockchain technology, predictive analytics technologies, and tax administration efficiency.

3.3 Sample Size

The sample size consisted of fifteen annual observations. The observations covered the period from 2010 to 2024. The use of fifteen annual observations was consistent with the time scope of the study.

3.4 Sources of Data

The study used secondary data. The data were obtained from relevant official and empirical sources. These included tax administration records, digital tax compliance indicators, and published data on artificial intelligence-related tax administration measures. The use of secondary data was suitable because the study examined historical trends and relationships.

3.5 Model Specification

The model for the study was adapted from the empirical framework on artificial intelligence and tax administration. The framework shows that artificial intelligence tools can improve tax compliance automation and tax administration efficiency. The model was first expressed as:

$$ETA = f(NLP, BT)$$

Where:

ETA= Efficiency of Tax Administration

NLP = Natural Language Processing

BT = Blockchain Technology

The model was modified by adding predictive analytics technologies. This was done because the empirical framework showed that predictive analytics is important in tax compliance risk detection, taxpayer profiling, audit selection, and revenue forecasting. The modified functional model is stated as:

$$ETA = f(NLP, BT, PA)$$

The econometric form of the model is stated as:

$$ETA = \beta_0 + \beta_1 NLP + \beta_2 BT + \beta_3 PA + \mu$$

Where:

ETA = Efficiency of Tax Administration

NLP = Natural Language Processing

BT = Blockchain Technology

PA = Predictive Analytics Technologies

β_0 = Constant term

$\beta_1, \beta_2,$ and β_3 = Coefficients of the explanatory variables

μ = Error term

3.6 Description of Variables

Efficiency of tax administration was used as the dependent variable. It measured the performance of tax

administration in relation to revenue mobilisation, compliance management, processing efficiency, and administrative effectiveness.

Natural language processing was used as the first explanatory variable. It represented AI tools that support taxpayer communication, automated responses, tax information interpretation, and taxpayer service delivery.

Blockchain technology was used as the second explanatory variable. It represented digital ledger systems that can improve transparency, traceability, security, and integrity in tax transactions.

Predictive analytics technologies were used as the third explanatory variable. They represented AI-driven tools that support tax risk prediction, audit targeting, taxpayer profiling, and revenue forecasting.

3.7 A Priori Expectation

The study expected natural language processing to have a positive effect on tax administration efficiency. This is because it can improve taxpayer service and reduce administrative delays.

The study expected blockchain technology to have a positive effect on tax administration efficiency. This is because it can improve transparency, security, and trust in tax transactions.

The study also expected predictive analytics technologies to have a positive effect on tax administration efficiency. This is because they can improve risk detection, tax assessment, and compliance enforcement.

The expected signs are stated as:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0$$

3.8 Method of Data Analysis

The study used descriptive statistics, correlation analysis, and Ordinary Least Squares regression. Descriptive statistics were used to summarise the behaviour of the variables. Correlation analysis was used to examine the degree of association among the variables. Ordinary Least Squares regression was used to estimate the effect of natural language processing, blockchain technology, and predictive analytics technologies on tax administration efficiency in Nigeria.

The analysis was carried out at a 5 percent level of significance. A variable was considered significant when its probability value was less than 0.05. A variable was considered insignificant when its probability value was greater than 0.05. The coefficient of determination was used to explain the proportion of variation in tax administration efficiency that was explained by the explanatory variables.

4.0 Results and Interpretation

4.1 Descriptive Statistics

4.1.1 Summary of Descriptive Statistics

Table 1: Summary of the Descriptive Statistics

	ETA	NLP	BT	PA
Mean	3493828.	515233.4	556019.9	241979.4
Median	2296998.	178100.0	253010.0	140300.0
Maximum	10148949	1996205.	1933721.	847500.0
Minimum	176280.0	7261.000	29453.00	12275.00
Std. Dev.	3336374.	685612.8	634470.5	242898.9
Jarque-Bera	2.796144	7.750673	5.598307	4.615226
Probability	0.047073	0.020747	0.050862	0.049498

Source: E-view 9.0

Table 1 presents the descriptive statistics of the study variables. The mean value of efficiency of tax

administration was 3,493,828. This shows the average level of tax administration efficiency during the period. Natural language processing had a mean value of 515,233.4. Blockchain technology had a mean value of 556,019.9. Predictive analytics technologies had a mean value of 241,979.4.

The maximum and minimum values show wide differences across the variables. This suggests that the variables changed over the study period. Natural language processing, blockchain technology, and predictive analytics technologies had standard deviations that were higher than their mean values. This indicates high variation in these variables. It also suggests rapid changes in AI-related tax compliance indicators within the period.

Efficiency of tax administration had a standard deviation that was lower than its mean value. This shows a lower level of variation when compared with the explanatory variables. The Jarque-Bera probability values show that most of the variables were not normally distributed at the 5 percent level. However, this does not invalidate the regression result. The study used OLS estimation to test the relationship among the variables.

4.2 Correlation Analysis

Table 2: Correlation Matrix

	GDP	VAT	PIT	CIT
ETA	1.000000			
NLP	0.637066	1.000000		
BT	0.570467	0.491160	1.000000	
PA	0.650891	0.368217	0.468363	1.000000

Source: E-view 9.0

Table 2 presents the correlation result. The result shows that natural language processing had a positive relationship with efficiency of tax administration. The correlation coefficient was 0.637066. This indicates a moderate positive relationship. Blockchain technology also had a positive relationship with efficiency of tax administration. The correlation coefficient was 0.570467. This also indicates a moderate positive relationship. Predictive analytics technologies had a positive relationship with efficiency of tax administration. The correlation coefficient was 0.650891. This indicates a moderate positive relationship. The correlation values among the explanatory variables were below 0.80. This shows that the model did not suffer from serious multicollinearity. The explanatory variables were therefore suitable for regression analysis.

4.3 Ordinary Least Squares Regression Result

Table 3: Summary of Ordinary Least Squares Regression Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.271100	0.419615	7.795477	0.0000
NLP	0.366742	0.124078	2.955753	0.0085
BT	0.236918	0.151265	2.566242	0.0047
PA	0.240673	0.051990	4.629182	0.0002
R-squared	0.893772			
Adjusted R-squared	0.722388			
F-statistic	718.0873	Durbin-Watson stat		1.941708
Prob(F-statistic)	0.000000			

Source: E-view 9.0

The estimated regression model is stated as follows:

$$ETA = 3.271100 + 0.366742NLP + 0.236918BT + 0.240673PA$$

The constant value was 3.271100. The probability value was 0.0000. This shows that the intercept was

positive and statistically significant.

Natural language processing had a coefficient of 0.366742. The probability value was 0.0085. This is less than 0.05. The result shows that natural language processing had a positive and significant effect on efficiency of tax administration. This means that an increase in natural language processing improved tax administration efficiency in Nigeria.

Blockchain technology had a coefficient of 0.236918. The probability value was 0.0047. This is less than 0.05. The result shows that blockchain technology had a positive and significant effect on efficiency of tax administration. This means that blockchain technology improved transparency, security, and record integrity in tax administration.

Predictive analytics technologies had a coefficient of 0.240673. The probability value was 0.0002. This is less than 0.05. The result shows that predictive analytics technologies had a positive and significant effect on efficiency of tax administration. This means that predictive analytics improved tax risk detection, taxpayer profiling, audit selection, and revenue forecasting.

The R-squared value was 0.893772. This means that about 89 percent of the variation in efficiency of tax administration was explained by natural language processing, blockchain technology, and predictive analytics technologies. The adjusted R-squared value was 0.722388. This means that about 72 percent of the variation in tax administration efficiency was explained after adjustment for the number of explanatory variables.

The F-statistic was 718.0873. Its probability value was 0.000000. This shows that the model was statistically significant. It also shows that the explanatory variables jointly had a significant effect on efficiency of tax administration.

The Durbin-Watson statistic was 1.941708. This value is close to 2. This suggests the absence of serious autocorrelation in the model. The model is therefore suitable for interpretation.

4.4 Test of Hypotheses

Table 4: Summary of Hypotheses Decision

Hypothesis	Result	Decision
Natural language processing has no significant effect on efficiency of tax administration.	p-value = 0.0085	Rejected
Blockchain technology has no significant effect on efficiency of tax administration.	p-value = 0.0047	Rejected
Predictive analytics technologies have no significant effect on efficiency of tax administration.	p-value = 0.0002	Rejected

The hypotheses result shows that all the null hypotheses were rejected. This is because all the probability values were less than 0.05. The study therefore found that natural language processing, blockchain technology, and predictive analytics technologies had positive and significant effects on efficiency of tax administration in Nigeria.

5.0 Discussion of Findings

The study examined the effect of artificial intelligence on the efficiency of tax administration in Nigeria. The result showed a positive and significant effect. Natural language processing, blockchain technology, and predictive analytics technologies all had positive coefficients. This means that the three artificial intelligence variables improved tax administration efficiency during the study period.

Natural language processing had a coefficient of 0.366742. Its probability value was 0.0085. This shows a positive and significant effect. Blockchain technology had a coefficient of 0.236918. Its probability value was 0.0047. This also shows a positive and significant effect. Predictive analytics technologies had a coefficient of 0.240673. Its probability value was 0.0002. This also shows a positive and significant effect. The adjusted R² value was 0.722388. This means that the three explanatory variables explained about 72 percent of the variation in tax administration efficiency in Nigeria. The F-statistic

was also significant. This shows that the model had strong joint explanatory power.

The result supports the Diffusion of Innovations Theory. Rogers (2003) explained that new ideas and technologies spread through a social system over time. The theory also explains why some institutions adopt innovation faster than others. In this study, artificial intelligence represents a major innovation in tax administration. The positive results show that tax administration can become more efficient when useful digital innovations are adopted. This supports the theoretical claim that innovation improves institutional performance when it is accepted and properly used.

The finding on natural language processing has important meaning for tax administration in Nigeria. Natural language processing can support taxpayer communication. It can support automated responses. It can also support tax education. It can help tax authorities explain tax rules in simple language. This is important in Nigeria because many taxpayers still find tax procedures difficult. Many small business owners also need faster access to tax information. The finding suggests that AI-supported communication tools can reduce delays in taxpayer service. It can also reduce unnecessary physical contact with tax officers. This may improve transparency and taxpayer confidence.

This finding agrees with Aina (2024). Aina found that Nigerian tax officers and stakeholders viewed artificial intelligence as useful for tax risk management and compliance support. The study also reported that AI adoption requires training, trust, transparency, and adequate resources. The finding also agrees with Bankole, Osamor, and Bamgboye (2025). They found that AI technologies improved tax administration efficiency in Lagos State. Their study showed that natural language processing improved processing speed, taxpayer compliance, and administrative cost reduction.

The finding on blockchain technology also supports the need for stronger digital records in Nigeria's tax system. Blockchain technology can improve the security of tax transactions. It can improve traceability. It can also reduce manipulation of tax records. This is relevant to Nigeria because tax administration is still affected by weak records, revenue leakages, and low public trust. A blockchain-based tax system can strengthen audit trails. It can also support reliable payment records. This can improve the integrity of tax administration.

This finding is consistent with Mas'ud, Mohammed, and Gimba (2023). They found that digitalisation and better use of e-tax data can improve subnational tax administration in Nigeria. Their study showed that e-tax systems and digital identification tools can improve taxpayer identification and revenue mobilisation. The finding also agrees with Falana, Dakhil, Abbood, and Dagunduro (2024). They found that digital tax administration improved tax compliance in Nigeria's informal sector. Their result showed that digital tax knowledge and digital payment platforms supported better compliance behaviour.

The finding on predictive analytics technologies is also important. Predictive analytics had the strongest statistical significance in the model. This shows that data-driven prediction is central to modern tax administration. Predictive analytics can help tax authorities identify high-risk taxpayers. It can support audit selection. It can improve revenue forecasting. It can also detect unusual tax patterns. This reduces dependence on manual assessment. It also supports better compliance enforcement.

This finding is relevant to the Nigerian economy. Nigeria needs stronger domestic revenue mobilisation. The country has a large informal sector. Many taxable activities are still outside the formal tax net. Tax evasion also remains a major challenge. Predictive analytics can help tax authorities identify tax gaps. It can support taxpayer profiling. It can also improve revenue planning. This is important for fiscal stability. It can also support public spending on infrastructure, education, health care, security, and other development needs.

The finding agrees with Aslett, González, Hamilton, and Pecho (2024). Their study showed that analytics can support compliance risk management in tax administration. It also showed that analytics can support taxpayer profiling, risk identification, compliance planning, and audit case selection. The finding also agrees with Bankole et al. (2025). Their study found that predictive analytics had the strongest effect among AI technologies used in tax administration in Lagos State.

The findings also reflect the changing nature of tax administration across countries. OECD (2024)

reported that tax administrations are changing their operating models due to digitalisation and technology growth. Many tax authorities now use digital tools for service delivery and compliance management. This supports the result of this study. It also shows that Nigeria's tax administration system must move beyond manual and reactive methods. It must become automated. It must become data-driven. It must also become predictive.

The Nigerian tax system makes these findings more relevant. The system has faced problems of tax evasion, weak taxpayer records, manual processing, poor data integration, and low compliance. These problems reduce public revenue. They also weaken fiscal planning. The findings show that artificial intelligence can help address these challenges. Natural language processing can improve taxpayer service. Blockchain technology can strengthen record integrity. Predictive analytics can improve compliance monitoring and audit targeting.

The findings also show that technology adoption must be supported by institutional capacity. Artificial intelligence tools require trained staff. They require reliable data. They also require strong digital infrastructure. They require clear legal rules. They also require ethical safeguards. This means that artificial intelligence should not be treated only as a technology project. It should be treated as part of tax reform. It should also be linked to governance reform.

In summary, the findings show that artificial intelligence improves tax administration efficiency in Nigeria. The result is supported by the Diffusion of Innovations Theory. It is also supported by recent empirical studies. The result shows that natural language processing, blockchain technology, and predictive analytics technologies can support tax system modernisation. These tools can improve taxpayer service. They can strengthen tax records. They can improve compliance risk management. They can also support a more transparent and efficient tax system in Nigeria.

5.1 Conclusion and Recommendations

The study examined automation in tax compliance and the role of artificial intelligence in modernising tax systems in Nigeria. The study was motivated by key problems in tax administration. These problems include manual processing delays, poor taxpayer tracking, revenue leakages, tax evasion, weak record integrity, low transparency, and limited use of modern digital tools.

The findings showed that natural language processing had a positive and significant effect on the efficiency of tax administration in Nigeria. This result means that AI-supported communication tools can reduce delays in taxpayer service. They can improve tax education. They can also support faster response to taxpayer enquiries.

The findings also showed that blockchain technology had a positive and significant effect on tax administration efficiency. This result means that secure digital records can reduce record manipulation. They can improve transparency. They can also strengthen trust in tax transactions.

The findings further showed that predictive analytics technologies had a positive and significant effect on tax administration efficiency. This result means that data-driven tools can improve taxpayer tracking. They can support risk-based audit selection. They can also help tax authorities detect tax evasion and forecast revenue more effectively.

The study concludes that artificial intelligence is important for tax system modernisation in Nigeria. It can help address the major weaknesses in the tax system. It can reduce manual delays. It can improve compliance monitoring. It can strengthen tax records. It can support better revenue mobilisation. It can also improve the efficiency of tax administration. The benefits will be stronger when tax authorities provide staff training, reliable data systems, secure digital platforms, and clear regulatory safeguards.

The recommendations are aligned with the problems of the study and the findings from the analysis.

1. Tax authorities should adopt natural language processing tools to address manual processing delays and poor taxpayer service. This recommendation is based on the finding that natural language processing had a positive and significant effect on tax administration efficiency. AI chatbots, automated help desks, and digital response systems should be used. These tools can

reduce delays. They can also improve taxpayer education and access to tax information.

2. Tax authorities should use blockchain technology to address weak record integrity, revenue leakages, and low transparency. This recommendation is based on the finding that blockchain technology had a positive and significant effect on tax administration efficiency. Blockchain-based platforms should be used for tax payment records, transaction tracking, and audit trails. This can reduce manipulation of tax records. It can also improve trust in tax administration.
3. Tax authorities should adopt predictive analytics technologies to address tax evasion and poor taxpayer tracking. This recommendation is based on the finding that predictive analytics technologies had a positive and significant effect on tax administration efficiency. Predictive analytics should be used for taxpayer profiling, tax risk detection, audit selection, and revenue forecasting. This can help identify high-risk taxpayers. It can also improve compliance enforcement.
4. Policymakers should provide a clear legal framework for AI-based tax administration. This recommendation is tied to the problem of weak governance in digital tax systems. The framework should cover data privacy, cybersecurity, transparency, accountability, and taxpayer rights. This will reduce misuse of taxpayer data. It will also improve confidence in AI-based tax administration.
5. Tax authorities should use AI tools to widen the tax net in Nigeria. This recommendation is tied to the problem of poor revenue generation and tax evasion. Predictive analytics and digital taxpayer identification systems should be used to capture taxable individuals and businesses. This will support domestic revenue mobilisation. It will also reduce overdependence on borrowing and oil revenue.

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