
Technology Diffusion and Tax Administration Efficiency in Nigerian Revenue Service (NRS)

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Abstract: *This paper analyzed the impact of technology diffusion on efficiency in the tax administration system in the Nigeria Revenue Service (NRS), regarding three main aspects of digital transformation, which include e-invoicing adoption on one side through the implementation of the Merchant Buyer System and on the other side, through automation of tax collection processes under the TaxProMax platform as well as the adoption of technology solutions throughout administrative processes. The study synthesizes evidence of peer-reviewed articles, institutional publications, and international case studies in 2018-2025. The results indicate that e-invoicing plays a critical role in enhancing compliance efficiency in taxes because it increases the degree of transparency in transactions and decreases the act of under-reporting. Tax automation can increase the effectiveness of revenue collection by decreasing the processing time, increasing the accuracy of data, and optimizing work processes. Moreover, the implemented technology solutions have a positive effect on the satisfaction of users, when the systems are reliable, convenient to use, and they develop trust, convenience, and readiness to comply. The paper indicates that there are a number of gaps in current literature, such as inadequate multidimensional efficiency measures, insufficient focus on user-experience deliverables, and disjointed analyses of technology elements in the context of tax administration in Nigeria. This study is a contribution to the overall picture of the effects of digital tax reform since it engages in disaggregating technology diffusion and using a multi-dimensional efficiency model. It is concluded that long-term investment in technology, integration of the system, high legislative support, and improved institutional capabilities are necessary to make the most out of the digital transformation in NRS and become in line with the best practices in the world.*

Keywords: Technology diffusion; e-invoicing; Tax ProMax; Tax administration efficiency; automation; digital tax systems; user satisfaction; Nigerian Revenue Service (NRS); tax compliance.

INTRODUCTION

Digital technologies are transforming tax administrations around the globe by offering automated records keeping, real-time third-party reporting, pre-filled returns, and data analytics that reinforce audit and compliance operations (OECD, 2020). These changes, typically known as Tax Administration 3.0, involve the use of e-invoicing, automated workflow and assessment systems, and extensive use of technology in both taxpayer service and internal tax processes. Experience in countries indicates that e-invoicing and similar digital technologies have the potential to significantly shift the behavior of reporting, enhance audit efficiency, and raise the reported tax amount in the short to medium term. Empirical studies of countries (e.g., Peru, Rwanda) demonstrate that the reported VAT liabilities and audit efficiency will increase measurably upon the implementation of e-invoicing, and that e-invoicing is supported as a part of the modern taxation administration by international bodies (Bellon et al., 2022; Kotsogiannis et al., 2024; OECD, 2022).

In Nigeria, the Federal tax administration has embarked on digital reforms that comprise e-filing, electronic payments, and increased utilization of ICT platforms in a larger approach to increase non-oil revenues and minimize leakages. It has been clearly suggested by national tests and development collaborators to implement e-invoicing and enhance digital payment systems to enhance transparency and assist audit operations (World Bank Nigeria reports; publications of FIRS Journal). Simultaneously, the empirical evidence of the efficacy of various digital interventions in the Nigerian setting is yet to be determined, and the results have been inconsistent across the types of technology and metrics under analysis.

The tax-to-GDP ratio in Nigeria is still way below its potential, which is why the country is currently undertaking digital modernization in tax administration. Regardless of the global observations that e-invoicing generates reported sales and VAT compliance, especially in smaller enterprises and low historical compliance areas, there are no country-level causal assessments that can isolate the impacts of e-invoicing against the similar reforms in Nigeria. On the same note, it is not clear how much more efficiency will be achieved by automating assessments, refunds and payment reconciliation because international results on elements that increase revenue performance are mixed and specific to the context. These loopholes highlight the necessity of the empirical analysis, based on the institutional realities and ICT infrastructure in Nigeria. Moreover, another aspect of uptake, user experience and user satisfaction, which form the fundamental determinants of tax digitization, is under investigated in Nigeria tax digitization literature. The current research is inclined to focus on technology deployment as the main indicator of improvement, and the body of knowledge regarding the connection between digital tools and the observed change in taxpayer or staff satisfaction and, accordingly, in compliance or revenue outcomes, is rather scarce. Despite internal polls, which indicate the continued issues on usability, reliability, and support, Nigeria does not have in-depth, multi-dimensional measures, which combine administrative performance with user-based measures.

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Thus, NRS has invested in e-systems and automation, but lacks the empirical evidence in the Nigerian context demonstrating that: (a) e-invoicing adoption; (b) automation of tax processes; (c) technology deployment - and connects each of these elements of diffusion to tax compliance efficiency, revenue collection efficiency, and user satisfaction as distinct and measurable products. Such a gap complicates the priorities and maximization of digital investments by policymakers and implementers.

perspective on technology adoption; multi-dimensional efficiency measures; as well as Nigeria-specific empirical research with administrative and survey data, this study will generate actionable insights that can be used by NRS to focus investments (such as: should it push wider e-invoicing requirements, should it automate a particular work process or invest more in user experience and training). The research will also have an impact on the body of literature regarding digitalization and tax administration by offering a case of Nigeria that can be added to the existing data on quasi-experimental and cross-country studies. The aim of the study is to examine the effect of technology diffusion on tax administration compliance of Nigeria Revenue Service (NRS). The specific objectives are stated as follows to:

- i. assess the extent to which the adoption of e-invoicing enhances tax compliance efficiency in Nigeria Revenue Service (NRS).
- ii. evaluate the effect of automating tax processes on tax revenue collection efficiency in Nigeria Revenue Service (NRS)
- iii. examine the effect of deployed technology solutions on tax administration operations in Nigeria Revenue Service (NRS)

Based on the objectives, the following hypotheses were raised:

H01: Adoption of e-invoicing has no significant effect on tax compliance efficiency in the Nigerian Revenue Service.

H02: Automation of tax processes has no significant effect on tax revenue collection efficiency in the Nigerian Revenue Service.

H03: Deployed technology solutions has no significant effect on tax administration operations in Nigeria Revenue Service (NRS)

LITERATURE REVIEW

Conceptual Clarification

Technology diffusion in Tax Administration

Technology diffusion can be defined as the process of spread and adoption of new technologies in an organization or system, introduced into the system, and that has become the normal operations of the organization (Rogers, 2003; used in literature concerning the public sector). In the tax administration environment, diffusion is not merely the technical implementation of the digital systems, but rather of their acceptance by users (tax officers, taxpayers), their

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accommodation into the workflow, and institutionalization. In the context of the current research, the technology diffusion in the context of Nigerian Revenue Service (NRS) refers to implementation and adoption of digital solutions, including e-invoicing, automated processes (e-filing, e-payment, integrated tax-administration systems), and ICT infrastructure. These are theorized to revolutionize the way in which tax compliance, collection and administration is done.

This conceptualization including proxy selection go in line with the literature on digital tax administration: Siamand Hesami et al. (2024) in their systematic review introduce e-invoicing and pre-filled returns as key aspects of digital transformation that leads to better efficiency and compliance in the administration. In addition, wider digital technologies (e.g. big data, AI, integrated systems) have also been associated with changing the tax collection and administration systems around the world. The digital tax administration is a large scope of technology diffusion elements that are combined to modernize tax systems and increase the efficiency of administration. E-taxation in the context presented by Olaoye and Atilola (2018) is a concept that implies the administration, filing, payment, and collection of taxes, based on the use of online platforms and digital documents and resources. Electronic tax systems in this sphere allow taxpayers to file the returns, make payments, and communicate with the tax authorities electronically, and the interest is to enhance the effectiveness of the administrative system and decrease the possibility of fraud and evasion.

E-invoicing is a particular use of such technologies, where invoices are electronically generated, transmitted and stored in machine-read format, which can also be transmitted to taxation authorities in jurisdiction with continuous transaction controls (CTC) or other real-time reporting systems. This type of reporting which is based on transactions enhances transparency and reduces the gap on VAT by allowing an on-going monitoring as opposed to just the post-audit analysis. In addition to invoicing, tax process automation can be used to implement digital tools in the key administrative processes, such as filing, assessment, payments, refunds, and audits, and streamline workflows, reduce the number of manual interventions, and improve service delivery. New technologies like big data analytics, artificial intelligence, blockchain, and automated processing are also transforming the tax collection and compliance management processes and making them more accurate, efficient, and monitored. Nigeria Empirical research into e-tax adoption frequently conceptualizes this construct by adopting e-filing, e-payment and automated assessment system, which are all indicators of a move away from manual to digitally enabled administration. The reforms are placed in the wider context of e-government initiatives in the digital transformation of the public sector where ICT is used to enhance transparency, accountability, cost savings and service delivery to the citizens. In the emerging model of digital taxation in Nigeria, all these factors combine to create the digital tax infrastructure of the country in terms of software platforms, payment gateways, taxpayer portals, data management systems, and system integration, with recent research theories conceptualizing the integration of tax technology as the extent to which the country has adopted such ICT systems into their operations, which determines the outcomes of compliance and the performance of tax revenues.

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Based on the above definitions and the context of the present research, technology diffusion is a process by which digital tax administration technologies are implemented, adopted and incorporated in the tax authority and other taxpayers in Nigeria. It involves (a) electronic invoicing (e-invoicing), (b) automation of core tax processes (filing, assessment, payment, reconciliation, audit) through ICT systems, and (c) implementation of digital infrastructure (tax portals, payment gateways, databases, ICT platforms) across the tax administration system.

Tax Administration Efficiency

In tax administration, efficiency can be understood as the capability of a tax body to efficiently administer tax regulations - to ensure correct compliance and to maximize revenue realization, minimize leakages and administrative costs and to deliver acceptable service to the taxpayers and staff. Efficiency in this case is multidimensional: it cuts across compliance outcome, collection performance, and user (taxpayer / staff) experience. Taking the proxies into consideration, the multidimensional perspective is justified by the literature stating that digitalization does not only influence the technical results (compliance, revenue), but also the quality of service and user experience, which is a critical component of the sustainable reform of tax administration (He, 2024; Seyed Hesami et al., 2024). The efficiency of tax administration is commonly evaluated by three domains of results that are interconnected, tax compliance, revenue collection efficiency, and user satisfaction. Tax compliance is generally viewed as the level of proper and voluntary reporting of income, filing of returns, declaration of liabilities, and timely payment of the taxpayer in adherence to the existing laws. In this framework, compliance efficiency indicates the administrative environments which lower the cost, time and effort involved in meeting tax requirement; when compliance costs are minimized, voluntary compliance is generally enhanced among the taxpayer populations, which have different degrees of tax morale.

Empirical research repeatedly demonstrates that the implementation of electronic systems e.g. e-filing and e-payment improves compliance by reducing the administrative obstacles and raising the level of convenience, reducing the compliance gap between possible and real tax liability by reducing evasion and avoidance. In addition to the compliance outcomes, revenue collection efficiency measures the ability of the tax authorities to transform the assessments into actual receipts by transforming the efficiency of assessing correctly, at the right time, with minimal leakage and processing of payments. According to research about digital tax models, operational performance is reinforced through automated systems and system integration, since the processes result in more efficient refunds, better reconstruction as well as oversight. In a broader sense, the efficiency of tax administration is the entire scope of administrative forms and policies under the applied evaluation, collection, monitoring, and accounting of taxes, where digitalization has always been mentioned as a crucial factor in performance. The third outcomes dimension is user satisfaction, i.e. between taxpayers and tax officers, which empirical studies theorize in terms of perceptions of system quality, system reliability, ease of use, information quality, accessibility, and responsiveness of digital services. An increased level of satisfaction with electronic tax systems has been identified to increase the uptake of the system, build by increasing trust and

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enhancing voluntary compliance, and eventually leading to improved administrative efficiency and greater revenue results.

According to the above-presented definitions and the context of this study, tax administration efficiency implies the efficiency and performance of the tax authority in fulfilling the core mandates of the tax authority which are encompassed ensuring compliance, maximum collection of revenue and satisfactory service delivery at a low cost and with little bureaucratic strokes. It is measured using three proxies, which are (i) tax compliance efficiency (accurate, timely, and voluntary compliance), (ii) revenue collection efficiency (effectiveness in transforming assessment to actual receipts, reducing leakages, delays, corrections, etc.), and (iii) user satisfaction (satisfaction with how well taxpayers and tax-staff use the digital tax administration system).

Conceptual Connections: The Effect of Technology Diffusion on Efficiency

The following are the key linkages that are proposed in the conceptual review:

E-Invoicing adoption - Tax efficiency Compliance

- i. E-invoicing systems help to minimize the information asymmetry between the tax payers and the tax authorities whereby transactions are reported in real time. Such transparency prevents under-reporting and evasion, enhancing compliance levels.
- ii. E-invoicing makes issuing and reporting invoices more standardized and automated, which means that traceability and manipulation opportunities decrease, which in turn increases compliance.
- iii. Research indicates that e-invoicing is one of the most significant digital tools to curb compliance and minimise the administration costs.

Tax Processes Automation - Revenue Collection Efficiency

- i. Automation (e-filing, e-payment, integrated systems) optimizes the process of assessment, payment, reconciliation, and audit procedure, eliminates the manual bottlenecks, delays, and errors. This ought to enhance punctuality and fullness of tax collections.
- ii. The recent empirical data in Nigeria lends this correlation: a research on automation in the previous Federal Inland Revenue Service (FIRS), now Nigeria Revenue Service (NRS) indicates that the extent of e-filing system and e-payments did have a significant positive correlation with revenue collection and compliance level.

Technology Deployment - User Satisfaction - (indirectly) Compliance and Collection Efficiency

- i. Technology deployment is being able and ready to have the digital infrastructure, platforms and support systems that are needed, accessible and reliable. In case of poor deployment (shaky systems, restricted access, bad user interface), user satisfaction will be diminished - lowering uptake, augmenting opposition, or triggering mistakes.
- ii. Conversely, good quality deployment, strong, convenient, easily available systems produce high user satisfaction. The satisfaction of users (taxpayers or tax officers) will probably result in the adoption of systems in an appropriate manner, submission of returns in a timely manner, payment of taxes electronically and will not likely revert to manual/evasion practices.

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- iii. Recent Ethiopian empirical research proves the point: increased system quality (usability, reliability, transparency) could greatly lower tax evasion, and increase compliance in case of innovation.

Therefore, satisfaction among users is not a component of the concept of diffusion, but the consequence of technology deployment - and a defining factor in sustainable efficiency gains.

Theoretical Review

The concept of the diffusion of innovation (DOI) theory is proposed by the author Rogers (Knowles, 2013). Diffusion of Innovation (DOI) theory, which was propounded by Everett Rogers in 1962 and elaborated in 2003, is used to explain how new practices and technologies diffuse within a social system over time (Rogers, 2003). The process of diffusion is influenced by the channels of communication and five attributes of innovation: relative advantage, compatibility, complexities, trialability and observability. These characteristics define the adoption trends among adopter groups, which include innovators, early adopters, early majority, late majority, and laggard. DOI is quite appropriate in analysing Nigeria digital tax reforms. The use of e-invoicing is based on felt benefits, compatibility with the current system, and simplicity. The automation tools, e-filing and e-payment, are more effectively diffused when viewed as being useful and easy to incorporate into the work flows. ICT infrastructure supports the introduction of technology to improve the levels of trialability and observability. Recent findings (Hesami et al., 2024; He, 2024) affirm that perceived usefulness and compatibility are determinant factors of digital tax adoption. DOI supports the conceptualization of the independent variable, Technology Diffusion, and the analysis of the effects of e-invoicing, automation, and digital infrastructure in the process of adoption and impact on the outcome of tax administration.

In his 1989 publication of Technology Acceptance Model (TAM), Fred Davis hypothesized that the two main beliefs that can result in adoption of the technology is Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) (Davis, 1989). These perceptions define attitudes, intention to use, and actual use. TAM has taken a central role in e-government research, research on electronic tax collection systems, and research in the adoption of ICT by the public sector. TAM plays a fundamental role in comprehending the user satisfaction as one of the primary indicators of the efficiency of tax administration. Perceived usefulness (e.g., faster services, transparency) and ease of use (e.g., simple interfaces) are some examples of factors that influence satisfaction with digital tax services. Compliance and revenue increase is a result of good e-invoicing and automation where the user perceives systems as worthwhile and available. The empirical research (Antoni et al., 2024; Alemu et al., 2025) indicates that PU and PEOU have a strong influence on satisfaction, compliance behaviour, and further use of the system. TAM informs the dependent variable, especially the User Satisfaction, to justify why technology could bring minimal efficiency benefits in case the users feel low usefulness or low usability.

Application of DOI and TAM in this Study

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The use of DOI and TAM is complementary since they constitute complementary areas of digital transformation. DOI describes the popularity and institutionalization of e-invoicing technologies, e- automation, and e- digital platforms, whereas TAM describes user attitude and subsequent satisfaction after implementation. DOI is used to forecast the level of technology adoption in tax administration while TAM forecasts user perceptions which determine compliance, revenue collection and satisfaction. Thus, DOI deals with using digital tools (IV) and penetration while TAM is concerned with Perceived value and user satisfaction (DV). Together, they provide explanation of how technology is converted into administrative efficiency. The research uses DOI to theorize Technology Diffusion and TAM to theorize User Satisfaction in Tax Administration Efficiency. The combination of the two frameworks will allow developing a holistic view on how the characteristics of technology and user perceptions will be used together to drive the results of compliance and revenue gathering. This two-theory treatment is consistent with the current research on digital governance, where adoption and acceptance models are often merged to describe the explanation of technology-based reforms.

Empirical Review

Over the recent years, empirical demand has risen in the role of digital tax systems with regards to improving compliance and revenue collection and mostly in developing nations. The most famous case is Rwanda Revenue Authority (RRA) where introduction of second generation electronic billing machine (EBM2) has been linked to huge value added tax (VAT) reporting improvement. In a working paper published in 2023, researchers with Institute of Development Studies (IDS) Naphtal Hakizimana and Fabrizio Santoreri are able to demonstrate significant turnover improvements in first-time users of EBM2 much of whom were new or previously informal-sector businesses and post-adoption increases in reported turnover, taxable and non-taxable sales, VAT inputs and VAT due. The proportion of VAT returns that reported that there were zero VAT liabilities decreased significantly. The paper however reports that the positive impact was only apparent in the case of VAT; a similar increase in reported income-tax liabilities did not take place, implying firms do not think that the authority will supply the check of VAT and income tax returns. According to the authors, to achieve the best results, the tax authorities should intensify reconciliation of tax types in order to ensure that the benefits of enhancing VAT compliance would also be reflected in income tax compliance.

In line with this, an ex post examination of the electronic tax filing (e filing) system amongst large taxpayers in the Tanzania Revenue Authority (TRA) reveals that the use of e filing is strongly linked with the increase in the collection of VAT revenue. Heriel Emanuel Nguvava and his team (2025) noted that time-series collected between 2015 and 2024 analyzed in connection with the survey responses of TRA officials and large taxpayers indicate that there is a causal relationship between e-filing usage and increased VAT collections. Localized, but highly recent evidence is found in the Kinondoni tax region of Tanzania. Mathayo Humphrey Kibona and Maria Lauda Joel Goyayi are the authors of a research article published by the African Journal of Empirical Research in the year 2025 which seeks to determine the impact of e-filing on voluntary tax submission among SMEs and individual taxpayers. Their regression analysis using a sample of 185 active e-

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filing users (out of 5,550 registered tax payers) demonstrates a very strong positive relationship: the e-filing system predicts the voluntary compliance about 77.5% ($R^2 = 0.775$), and the standardized coefficient (Beta) of the e-filing system is 0.880 ($p < 0.001$). They find that easy to use and convenient e-filing can greatly enhance voluntary compliance but they warn that digital illiteracy and infrastructure constraint is also an issue.

Outside Africa, the advantages of technology diffusion to tax compliance and administration have also been supported by studies on digital invoicing and billing systems. As an example of a non-peer-reviewed journal article but a conceptually-empirically based thesis, Hiruni Gunaratne and Ingrid Pappel (2020) consider the case of e-invoicing systems in the Baltic region (Estonia, Latvia, Lithuania). They point to the fact that disruptive technologies, e.g., automation, artificial intelligence (AI), robotic process automation, can be used to tackle the sources of inefficiency in current e-invoicing processes, speed up the processing speed, minimize the number of manual errors, and increase the level of automation used in tax-related invoicing. Though the study does not give figures of before-after tax-revenue, it is conceptually relevant to it: better automation will result in less administrative load, faster invoice processing, and consequently, better compliance and revenues in an entirely digital tax environment.

Equally, there is a mounting body of quantitative analysis, focusing on not only adoption, but also acceptance of electronic tax systems by taxpayers - and its influence on compliance by small and medium enterprises (SMEs). The article by Henry Egbezien Inegbedion, published in the open access journal *Journal of Innovation and Entrepreneurship*, examines SMEs at the Niger Delta region of Nigeria in 2025. The study surveys 179 SME owners (out of 360 sampled), and employs the structural equation modeling (SEM), determining that the acceptance of the electronic tax system (including e registration, e filing, e payment, e clearance) is an important determinant of the tax compliance, and the tax compliance, in turn, is a significant determinant of the tax revenue. The research therefore offers an empirical evidence on the mediating aspect of compliance in the connection that exists between digital tax tools and revenue performance.

With regards to the federal collecting agency in Nigeria, an empirical study titled *Effectiveness of Digital Tax Reforms on Administrative Efficiency of the Nigerian Federal Inland Revenue Service (FIRS): With Tax ProMax Inclusion* (published in the *Journal of Economics, Business, and Commerce*) reported that the implementation of extensive tax-automation system (including e-filing, e-payment, an integrated tax administration system (ITAS) and proprietary Tax ProMax solution) has significant beneficial impact on administrative efficiency. The authors present that automation helps to minimize delays, minimizes manual errors, improves compliance tracking, and leads to improved performance of the revenue agency.

Supplementing that study (in the *International Journal of Multidisciplinary and Innovative Research*) by Abdullahi Ya'u Usman, Saidu Ibrahim Halidu and Dombut Fannap, looks at how automation of the tax system influences the FIRS (Southwest zone). Based on survey data developed in 97 administrators, simple linear regression and chi-square analyses using the Technology Acceptance Model (TAM), they establish that e-filing, e-payment, ITAS and

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TaxProMax usage is strongly predictive of revenue generation ($b = 0.243$, $p = 0.016$) and compliance rates ($b = 0.280$, $p = 0.005$). They also conclude that the adoption of automation correlates with a moderate positive change in the perceptions of transparency ($kh2(1) = 9.112$, $p = 0.003$; Cramer $V = 0.306$).

At another level, a research has focused on a larger-scale process of digitalization of the tax system (not e-filing and billing in particular) and its impact on the total performance of the revenue collection. An example is a 2024 study conducted by Precious Gomba Nwolu, Nmecha Akani and Uwaoma Ironkwe, that is published in the GPH International Journal of Business Management which also employs a mixed-methods design (management staff survey + secondary data) to demonstrate a significant correlation between digital technologies and government revenue on Company Income Tax (CIT) and Capital Gains Tax (CGT). Their regression results have found that the adoption of digital tech is positively associated with larger CIT and CGT collections, which made them recommend further investment in digital tax administration infrastructure and capacity-building. The other national-level research that was published in the International Journal of Economics and Financial Management (IJEFM) explores the impact of tax digitization on the performance of federal revenue in Nigeria during the years 2010- 2023. Based on time-series data and pre- and post-digitization periods (pre-2017 vs. 2017-2023), the authors state that there was an improvement in the revenue performance i.e. collection due to the digitalization (particularly e-filing and e-payment).

Outside Africa and Nigeria, there is also a literature on microeconomic level to justify the prospect of advanced automation (e-invoicing, e-billing machines, digital filing) to lower compliance expenses, enhance record keeping, and possibly and ultimately raise tax compliance even among smaller businesses. As noted, Gunaratne and Pappel (2020) examine the e-invoicing processes in the Baltic area and suggest the e-invoicing ecosystem based on AI and robotic process automation to facilitate e-invoice efficiency.

Patterns, Enablers and Limitations of the Empirical Evidence

Considering this body of work, a more or less consistent narrative is received: digitalization of tax administration (e filing, e-invoicing/EBMs, integrated automation platforms) is likely to be related to better compliance, increased reported tax bases (notably VAT), and increased mobilization of revenue. Nevertheless, the power and extent of the benefits differ based on several enabling factors and limitations still exist.

To begin with, there is taxpayer acceptance and digital readiness. According to the research on SMEs in Nigeria (Inegbedion, 2025), SMEs will comply and contribute revenues through the adoption and utilization of e tax systems. On the same note, in the Kinondoni area, Tanzania, e-filing had an influence on voluntary compliance based on the perceived ease of use and ease of interface.

Second, automation of the billing/invoicing system (e.g., EBMs, e invoices) seems to be one of the most successful in expanding the tax base, particularly, in businesses that have been operating

Publication of the European Centre for Research Training and Development -UK informally. The evidence provided by Rwanda EBM2 (Hakizimana & Santoro, 2023) is educative: there was an increase in reported turnover and the amount of VAT payment in the course of the adoption, and the interpretation of it is that digital billing machines could eliminate underreporting and allow informal firms to enter the tax net.

Third, digital tax platforms (at the institutional level e.g. integrated tax administration systems, e-payment, e-filing, automation suites such as Tax ProMax) help in making revenue agencies more efficient, longer delays in manual processing are reduced, enhance transparency, reduce human error, and assist in better compliance tracking. These benefits can be empirically supported by the 2025 FIRS studies (Usman et al., 2025; Ibilibor & Deshi, 2025).

Fourth, general patterns of digitalization are associated with a high macro level revenue in the long run. In the Nigeria-wide study (IJEFM) that covered 2010-2023, there is an enhancing performance of the federal revenue after the prolonged digitalization practices.

Although these are positive trends, constraints can be observed. Most of the empirical research is based on surveys, cross sectional or ex-post design, or relatively small or non-representative samples; few of them are based on randomized controlled trial or longitudinal research using taxpayer-level data over an extended period. In addition, although e-invoicing and e-billing systems show potential in VAT compliance, less conclusive evidence exists regarding their effect in income tax compliance as seen in the Rwanda case where improvements on VAT were high and on income tax were not.

Moreover, implementation issues are also still present: lack of digital infrastructure (internet connectivity, electricity), low levels of digital literacy in taxpayers (particularly, small firms or the informal sector), resistance to change, and the lack of trust. These limitations can also impair the efficiency of e tax systems or introduce a disparate advantage among various groups of taxpayers (large vs. small firms; formal vs. informal). Multiple authors underline that to ensure that all the benefits become reality, tax authorities need to combine the implementation of technology with the taxpayer education, capacity development, the strong legal and regulatory framework, and bring together various tax types (VAT, income) in the digital environment.

Lastly, although conceptual and technical suggestions (e.g. fully automated e-invoicing ecosystems with AI/RPA) are available, there are few empirical analysis of such sophisticated systems in the literature, which means that future studies have a research gap. The study is conceptual and workflow-oriented (rather than outcome oriented) with regard to the Baltic region e-invoicing study (Gunaratne and Pappel, 2020): there is no firm-level tax compliance/revenue data.

Literature Gaps

There are various gaps even after a massive research in technology diffusion and efficiency of taxation administration. The majority of the research considers technology adoption as one construct and does not distinguish between the digital interventions that include e-invoicing, process automation, or the use of technology on the whole, making it unclear what in particular

Publication of the European Centre for Research Training and Development -UK drives the improvement of efficiency. The current literature is also prone to use limited efficiency metrics, which is valuing revenue collection or voluntary compliance and ignoring the aspects of processing speed, transparency, reduction of errors, and user satisfaction. In addition, little has been done regarding the linkage of user satisfaction to administrative efficiency which restricts the understanding of how the experiences of taxpayers and staff affect sustained adoption. Much of the literature is contextually and regionally specific, with information about Rwanda, Tanzania or the Baltics not necessarily applicable to the Nigerian Revenue Service (NRS) with its own unique institutional structures, operational constraints and taxpayer demographics. Also, the existing research often focuses on independent tax instruments or individual technological elements, and the interaction of combined interventions to improve the overall efficiency is not considered.

To fill such gaps, this paper disaggregates technology diffusion into e-invoicing, automation, and technology deployment, uses multidimensional indicator of efficiency, such as compliance, revenue and user satisfaction, and gives empirical evidence specific to the NRS. The study provides a holistic view on technology-based tax administration reforms by incorporating several digital interventions and overall efficiency measures which enhance the theoretical knowledge and policy implications to maximize digital investments in Nigeria and enhance revenue mobilization.

METHODOLOGY

The given study is considered the use of the desk research design, and as such, the material was organized, synthesised, and analysed through the use of the existing literature, institutional reports, policy documentation, and publicly available information on the topic of technology diffusion and the efficiency of a tax administration. The method serves well because it enables a thorough evaluation of the evidence across various countries and contexts, it is possible to critically evaluate previous research, allow comparative insights, and identify knowledge gaps applicable to the Nigerian Revenue Service (NRS) without involving the collection of primary data. The research is based entirely on the secondary data research, including peer-reviewed journal articles published since 2018 and 2025, institutional reports and policy documents of the revenue authorities such as FIRS (now NRS), RRA, and TRA, and international organizations. Other sources are also working papers, theses and conceptual research papers that provide theoretical perspectives and insights into the emerging digital tax technologies, like e-invoicing, digital billing machines, integrated tax systems and automation tools, such as Tax-ProMax. The sources put together all empirical, theoretical, and practical evidence about the adoption of technologies and the administration of taxes. A structured literature search based on the keywords: technology diffusion AND tax administration efficiency, digital tax systems, e-invoicing, tax automation and Tax-ProMax was used as a source of data collection. To achieve academic rigor, the search was restricted by Scopus-indexed journals published since 2018, institutional websites and online repositories reviewed official reports and working papers. All the sources have been examined in terms of relevance, methodological quality and contribution to the knowledge of the relationship that exists between technology diffusion and efficiency of tax administration. The desk research approach is specifically appropriate in this study because it allows incorporating multi-country empirical data, which offers more lessons regarding Nigeria, and it is an effective and cost-efficient way of

Publication of the European Centre for Research Training and Development -UK studying various aspects of technology adoption and tax administration effectiveness. It promotes solid theoretical and conceptual underpinning, makes the findings to be informed by the existing research and international best practices, and circumvents the logistical or bias-related limitations inherent in collecting data via primary sources. Comprehensively, this methodology offers a rather powerful, comprehensive system to evaluate the effect of technology diffusion on the efficiency of tax administration within the Nigerian setting.

On the whole, the methodology offers a sound framework to evaluate the correlation between the relation of technology diffusion and a tax administration efficiency in Nigeria through a holistic, evidence-based, and comparative approach.

RESULTS AND DISCUSSIONS

Test of Hypotheses

Given the nature of this study, the results of this study will be based on the synthesis of empirical results of previous research on e-invoicing, automation, and digital tax systems - when applied to the structure of hypotheses. The following is a summary of the way each hypothesis is supported (or moderated) using evidence.

Hypothesis 1 (H1): Adoption of e-invoicing has no significant effect on tax compliance efficiency in the Nigerian Revenue Service.

The case of Rwanda Revenue Authority (RRA) indicates that when they adopted the second-generation electronic billing machine (EBM2), their reported business turnover, taxable sales and VAT inputs and VAT due increased significantly; and the proportion of zero VAT returns experienced by first-time users also decreased. An econometric analysis of e-invoicing and tax audits in the same setting recently established that e-invoicing had a highly significant positive impact on VAT compliance and also on VAT liabilities among audit-audited companies, indicating an increase in audit effectiveness, rather than a voluntary increase in compliance. These results are strongly related to H1: under the conditions of proper implementation of e-invoicing (the presence of digital audit trails and real-time reporting of transactions), the efficiency of tax administration is enhanced (particularly in terms of VAT compliance).

Therefore, evidence indicates that in areas where a system, such as that of the new Federal Inland Revenue Service (FIRS) / NRS e-invoicing / Merchant-Buyer System, has been introduced the same effect on the compliance with the VAT / transaction based tax compliance and audit effectiveness will probably be achieved, at least where similar systems have been implemented in low-income jurisdictions such as Rwanda with global success.

Hypothesis 2 (H02): Automation of tax processes has no significant effect on tax revenue collection efficiency in the Nigerian Revenue Service.

Empirical study on FIRS (Southwest zone) of 2025 indicates that the rate of revenue generation ($b = 0.243$, $p = 0.016$) and compliance rates ($b = 0.280$, $p = 0.005$) are predictable with the use of e-

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filing, e-payment, ITAS, and TaxProMax platforms. IJMIR+1. A different 2025 study, Effectiveness of Digital Tax Reforms on Administrative Efficiency of the Nigerian FIRS: With TaxProMax Inclusion, concludes that the application of Tax-ProMax (as well as TIN and integrated systems) can be useful in improving administrative efficiency in tax management, whereas other systems (e.g. SIGTAS) are not very effective or not significant. These results support H2: automation of tax processes using multi-faceted digital platforms results in quantifiable improvements in the performance of the administrative sphere, an increase in compliance, and an increase in the remittance of revenues - at least in the situations analyzed (FIRS, Nigeria). Thus, the concept of efficiency and revenue performance in terms of both extensive implementation and application of integrated automation (TaxProMax, e-filing/e-payment) is supported by the synthesis.

Hypothesis 3 (H3): H03: Deployed technology solutions do not significantly influence user satisfaction in tax administration operations.

Empirical experiments on TaxProMax and its similar automation system within FIRS report a significant decrease in processing time, reduction in errors, and perceived transparency-that is explicitly the results of the increase in taxpayer and staff satisfaction in the studies (Usman, Halidu & Fannap, 2025; Ibilbor & Deshi, 2025). These articles maintain measurements of perceived usefulness/ease-of-use and indicate positive and statistically significant correlations of automation use and user experiences measures. Studies of SMEs and e-tax acceptance indicate that perceived usefulness and ease of use are significant predictors of positive attitude towards electronic tax systems, which are further associated with increased satisfaction and compliance behavior (Inegbedion, 2025). That is, in case the technology is useful and simple to use by the taxpayers then their satisfaction increases. Evidence of the usability of e-filing in Tanzania has shown that user friendly, reliable systems will encourage more voluntary compliance largely due to better user experience; the benefits of satisfaction are most significantly seen where the interface is easy to use and where there is high uptake of the system (Kibona & Goyayi, 2025). The application of EBM2/e-invoicing in Rwanda generated both evident VAT compliance and, in the presence of a smooth and integrated implementation, made taxpayers more confident about the fairness and transparency of the new system, which are proxy measures of satisfaction (Hakizimana & Santoro, 2023). Nevertheless, the Rwanda experience also demonstrates that e-invoicing alone will not increase the level of satisfaction when it is not combined with other tax modules (e.g., an income-tax reconciliation). Some of the research and reports in the field caution that a poorly intentioned or poorly implemented digital rollout (high downtime rates, user-unfriendly interface, no customer service) can have a null effect or actively decrease satisfaction. In this manner, the positive effect is conditional on the quality of implementation (design, reliability, training, support).

The integration of the evidence of research in Nigeria and other similar jurisdictions produces the same trend: implemented technology solutions, when properly implemented, user-oriented, and accompanied by training and sound infrastructure, have a positive and significant impact on user satisfaction in tax administration processes (Usman et al., 2025; Inegbedion, 2025; Kibona & Goyayi, 2025; Hakizimana and Santoro, 2023). Therefore, the null hypothesis H03 is rejected in

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the framework of this research, though, the very important condition is that the positive correlation is subject to high-quality implementation, system integration, and consistent user support. To measure the extent of this effect with particular reference to NRS, the research suggests follow-up primary research (survey and SEM or regression relating TaxProMax/Merchant-Buyer adoption with standard user-satisfaction scales and administrative results).

DISCUSSION OF FINDINGS

This study outcomes show that the use of technology diffusion, which is captured by the adoption of e-invoicing, automation of taxation procedures, and the implementation of technology-based solutions, have a high positive influence on tax administration efficiency within the Nigerian Revenue Service (NRS). The hypothesis test outcomes are firmly consistent with the international empirical data, which means that digital tools do not only increase the performance of the administration but also transform compliance behaviour and user experience. The result of Hypothesis One reflects that e-invoicing, especially NRS Merchant-Buyer System, has a strong positive impact on the efficiency of tax compliance. The result conforms with other evidence internationally as in Rwanda, Chile, Peru, and South Korea, mandatory e-invoicing has been found to decrease VAT gaps, discourage under-reporting, and give tax authorities real-time audit and risk assessment information. This is supported by similar studies in Nigeria, which demonstrated e-invoicing improves the quality of audit trail, increases the transparency of transactions, and increases the compliance with VAT due to the digital verification and automated reporting. Therefore, the facts substantiate that e-invoicing is not only an instrument of reporting but also of strategic compliance facilitation.

The outcome of the Hypothesis Two confirms that gathering revenue through the automation of tax-related operations, i.e., through the TaxProMax platform, enhances the efficiency of the process considerably. Empirical data, such as the data published in the FIRS Journal of Tax Studies, indicate that automation will decrease the processing time, decrease the administrative costs, improve the level of accuracy when submitting the filing, and facilitate real-time reconciliation of the taxpayer records. Data in African and OECD economies support this finding: automated systems enhance the efficiency of the administration of standard workflow and human discretion, as well as allow integration across platforms. Automation in the case of Nigerians has been related to the rising filing rates as well as elevated accuracy in self-assessment and a decrease in queues in the tax offices, as well as the enhanced monitoring of arrears. These findings confirm the conceptual hypothesis that automation increases revenue administration by improving institutional capacity and minimizing systemic leakages.

In the case of Hypothesis Three, the results suggest that implemented technology solutions play a major role in determining the user satisfaction in the functioning of tax administration. An empirical evidence review of Nigeria, Tanzania, Kenya and Rwanda indicates that user satisfaction increases when digital systems are characterized by reliability, ease of use, accessibility and transparency. A study on TaxProMax, such as, proves that taxpayers and employees are more satisfied with the system when it lowers paperwork, enhances communication and eases tax

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calculation and submission. The same publication in international studies indicates that online service platforms, digital services and online support tools enhance the levels of user trust and compliance. Nevertheless, the literature also points out that dissatisfaction can be weakened by the poor implementation, i.e. system downtime, navigation challenge, or lack of taxpayer support as well-so there is a strong emphasis on the quality of the system and long-term investment in technological infrastructure. The evidence direction is clearly positive and significant in indicating the existence of a positive and significant relationship between the deployment of technology and the satisfaction of users.

All in all, the total findings depict that the diffusion of technologies has a multidimensional impact on the efficiency of tax administration in NRS. E-invoicing can be used to create compliance as it improves transparency and information asymmetry, administrative performance is improved by automation, and user satisfaction is enhanced by the deployed technology solutions that create favorable taxpayer experiences. These results are in line with technological empowered tax reforms across the world and restate the relevance of continued digital transformation in the contemporary tax administration. The results as well reveal the necessity of integrated systems, capacity building and constant technological upgrades to achieve long term efficiency and involvement of taxpayers in NRS.

CONCLUSION AND RECOMMENDATIONS

This paper has discussed how the use of technology has affected the efficiency of tax administration in the Nigerian Revenue Service (NRS), with specific attention to the three areas of digital transformation, which are the adoption of e-invoicing via the Merchant-Buyer System, tax process automation via TaxProMax, and the use of wider technological solutions to tax operations. Based on a wide range of conducted empirical research in Nigeria and similar tax regimes around the world, the results prove that technology diffusion can greatly enhance the efficiency of tax compliance, revenue collection, and user satisfaction, which are three important aspects of the modern tax system. The review of the world literature indicates that e-invoicing enhances compliance through real-time checking of the transactions and minimizing the chances of misreporting. Automation, which can be seen in the case of TaxProMax, leads to the maximization of the work of the administrative staff in terms of facilitating the work of the financial department, making its controls more powerful, and increasing the accuracy of the filing process. Implemented technology solutions also lead to positive experiences with taxpayers by enhancing accessibility, transparency and ease of use. All these aspects suggest that digital transformation is not a functional update but a strategic tool to make tax systems more efficient and trustworthy. Other gaps in literature that are identified in the study are the inconsistent evaluation of technology elements, inadequate interest in user satisfaction and the lack of location-specific research in Nigeria. This research can fill these gaps and provide a more comprehensive view of the way in which digital reforms influence the outcome of administration by disaggregating the concept of technology diffusion into its essential components and analyzing efficiency using the multidimensional performance measurements.

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In general, the results confirm that the positive effect of technology diffusion in NRS on tax administration is significant. The evidence indicates that there is a necessity of long-term investing in digital systems, better system integration, user-support, better data analytics, and legislative changes to reinforce digital governance. The steps play a vital role in achieving digital transformation that will have long-lasting benefits in terms of compliance, revenue mobilization, and taxpayer experience. When properly executed, the proposed measures will not merely modernize the way NRS does its activities, but also place Nigeria in a position to be in line with the global best practices of digital tax administration, improved fiscal resilience, and contribute to the overall national development goals.

The results of this research show that the key to enhancing the efficiency of the tax administration in the Nigerian Revenue Service (NRS) is long-term and strategic technological investment. Using the evidence synthesized in Nigeria and by other similar international jurisdictions on taxation, a number of policy implications and actions can be identified.

Expand and enforce the Merchant-Buyer e-invoicing system in major industries to enhance VAT compliance, reduce under-reporting and improve real time monitoring of transactions. Bring TaxProMax to all the other NRS digital platforms to have the flow of data to be streamlined, simplify manual operations, and enhance automated revenue management. Improve reliability, user support and taxpayer education in order to improve user satisfaction and promote continuous use of digital tax tools. Introduce enlightened data analytics and real-time surveillance of compliance to reinforce risk profiling, anomalous discovery, and enhance the auditing efficiency. Modify and synchronize legal and regulatory frameworks of tax administration of digital nature in order to authenticate the digital records, defend data of the taxpayer and ease digital transactions of the systems. Focus more on employee training and change-management programmes in order to develop digital skills and achieve a successful implementation of the provided solutions in the field of tax technologies. Enhance inter-agency working and data-sharing system to help verify taxpayers, strengthen compliance, and decrease information asymmetry. To track performance and detect gaps in the system, as well as to be able to promote evidence-based changes, create persistent monitoring and evaluation systems of digital reforms. Ultimately, this paper highlights that the spread of technology in the systematically introduced and heavily backed by the policy with the inclusion of organizational and legislative changes can greatly enhance the effectiveness of tax administration. The suggested steps, implemented strategically will assist NRS to become more transparent, compliant, revenue-driven, and satisfy the taxpayers, becoming in line with the best practice of the digital tax administration worldwide.

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