PROSPECTS, CHALLENGES, AND IMPLICATIONS OF DEPLOYING ARTIFICIAL INTELLIGENCE IN TAX ADMINISTRATION IN DEVELOPING COUNTRIES

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ABSTRACT. Artificial intelligence (AI) can help transform tax administration in developing countries by automating certain functions, pinpointing patterns and irregularities, and forecasting future tax collections. AI can enhance the effectiveness, efficiency, and tax justice in tax administration. This paper discusses the development and deployment of AI in tax administration in developing countries. This paper outlines different AI technologies, the opportunities and challenges of using AI in tax administration, and the possible implications. The paper established that there is an increasing interest in harnessing AI in tax administration in developing countries. The challenges of deploying AI include a lack of quality data, inadequate technical expertise, and a paucity of clear legal and regulatory frameworks to govern the application of AI. The benefits of AI in tax administration were found to encompass increased tax revenue mobilisation and the attainment of sustainable development goals. Reduction in corruption, improved tax compliance, reduced tax avoidance and evasion among other benefits. The paper recommends that policymakers and tax authorities in developing countries improve data quality to support AI adoption, invest in AI research, innovation and development while supporting training in AI as well as the creation of a clear legal and regulatory framework.

Keywords: artificial intelligence (AI), challenges, developing countries, implications, opportunities, tax administration

JEL classifications: H20, H21, H26, O33, K3

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Introduction

Artificial intelligence (AI) is a "buzz" word, topical in advanced technology, digital transformation, economic growth and sustainable development discussions (Mhlanga, 2023). AI is one of the Fourth Industrial Revolution tools that has been widely adopted. Munoko et al. (2020) explain AI as a new technology that mimics and replicates cognitive human judgement and skills. In concurrence, Shakil & Tasnia (2022) describe AI as intelligent systems with the ability to analyse data and build a strong base for decision-making. Albawwat & Al Frijat (2021) observe that AI technologies can reproduce human skills such as hearing, problem-solving and doing logical tests AI has the potential to revolutionise all sectors of the economy, it has modified manufacturing operations, the business environment, financial services, and even social interactions. AI technologies include natural language processing, deep learning, expert systems, big data, data analytics, cloud computing and internet of things among others.

Artificial Intelligence (AI) concerns a group of technologies by which intelligent devices have abilities resembling those of humans such as learning, improving, doing calculations, making decisions and being innovative (Mhlanga, 2023). Advanced technological modifications and developments in hardware and software have accelerated advancements in AI technology, its adoption and implications for businesses, individuals, societies, and economies. AI is likely to catalyse development, economic growth as well as improve the quality of information and statistics thus enabling developing nations to leapfrog over certain conventional obstacles (Susar & Aquaro, 2019; Zafar & Villeneuve, 2018). Despite the possible positives associated with AI, challenges such as AI adoption affects jobs, ethical concerns regarding certain applications and capacity-building requirements as well as implications for the future generation (sustainability, sustainable development and tax education). All these issues need to be evaluated by countries seeking to adopt AI for public administration and e-government.

Tax is a source of funds for both local and central revenue in developing countries (Sebele-Mpofu, 2020). With the reduction in donor funds, development assistance and other international grants, developing countries have been undertaking different initiatives to strengthen their domestic revenue mobilisation

strategies. Harnessing AI in tax administration and the digitalisation of tax administration are some of the measures adopted by developing countries. Tanzania is also one such country (UNDP, 2022). Strengthening domestic revenue mobilisation in developing countries is likely to strengthen sovereignty, reduce aid and donor dependence and increase revenue generation for public finance for the attainment of the sustainable development goals or SDGs (Mpofu, 2021a; 2022a). Therefore, tax system reforms are required in many developing countries to minimise the unfavourable effects of taxation, increase tax compliance, alleviate poverty and fund investment in infrastructure, education and health. Technology is possibly the biggest weapon available that developing countries can exploit in their fight to strengthen their tax administration systems (Walker, 2019). The SDGs are made up of 17 goals that United Nations member countries agreed to work towards achieving in the 2015 Paris Agreement. Most of these SDGs directly touch on tax issues (Walker, 2019) because achieving them requires financial resources and taxation is key in mobilising these resources (Mpofu, 2022b, 2023a)

The use of AI technologies such as deep learning, machine learning, expert learning system, and optical character recognition in addition to other technologies to build tax intelligent systems contributes to the efficiency in dealing with tax-related issues and the effective monitoring of tax-connected risks (Mpofu, 2024). It also assists in reducing human-driven judgement, standardising taxation behaviours and minimising administrative as well as compliance costs. The implementation of AI in the taxation tax administration is associated with governance challenges and other AI-connected risks that might be more pronounced in developing countries due to the political, social, economic, environmental and digital infrastructure contexts in these countries (Zhou, 2019).

Tax evasion is a fundamental matter in developing and emerging economies, where revenue administration is still manually done. Individuals and companies exploit the loopholes and inefficiencies associated with traditional methods of tax administration. Artificial intelligence in tax administration can assist businesses to uphold transparency and compliance with tax regulations, minimising the risks of default, penalties and fines (Shakil & Tasnia, 2022).

According to Serrano Antón (2021), the use of AI by tax administrations can transform tax administration and compliance procedures resulting in the implementation of novel data-oriented tax administrations, automation of repetitive tax administration tasks, heightening efforts toward reducing tax evasion while strengthening communication and information exchange between tax authorities and taxpayers. Moloi & Marwala (2021a) posit that RPA (Robotic

Process Automation) has several benefits, and these include enhanced accuracy, the reduction of costs, e improvements in the governance, better customer advocacy and strengthened customer loyalty. Therefore, the use of RPA in tax administration can improve monitoring by enabling better checks and balances as well as efficiency in integrating existing technologies with new digital technologies. Combining RPA with machine learning and other AI technologies, robotics can also strengthen tax administration and enforcements, especially tax compliance audits (Al-Aroud, 2020; Mpofu, 2023b). Audit procedures to check and verify audit assertions such as authorisation, occurrence and completeness employed by auditors can be automated. This could give auditors time to focus on more complex tasks that demand human cognition. Serrano Antón (2021) emphasises that tax administration authorities need to reflect on data governance concerns and other probable risks linked to the application of AI in taxation, especially how to ensure the responsible, transparent, unbiased and ethical usage of AI in tax administrations, which respects taxpayers' rights while allowing for effective revenue mobilisation. Modern revenue administration authorities need to be effective, efficient and transparent in addressing tax evasion.

Bassey et al. (2022) contend that developing countries need to explore not just how to build technology acceptance but also explore the creation of a wider digital ecosystem in revenue administration in their countries to improve domestic revenue mobilisation. Additionally, the researchers portend that understanding the contextual environment, stakeholders and their needs, technological requirements and the envisaged outcomes as pivotal components of a digital ecosystem is important for tax administrators in developing countries. Ultimately, Bassey et al. (2022) and Faúndez-Ugalde et al., (2020) highlight the need for research on digital tax administration in developing countries.

Culminating from the brief background given above, through a critical literature review this paper discusses the development and deployment of AI in tax administration in developing countries. The review seeks to explore the state of the art of AI applications in tax administration in developing countries. Through the review of literature, the paper unpacks the possible opportunities, implications and challenges linked to AI in tax administration and contextualises these to the contextual environments in developing countries. The paper consists of five sections. The first section sets the tone of the paper by giving a contextual background on AI in developing countries and the challenges of tax revenue mobilisation in these countries. Section two gives a brief articulation of the review methodology.

Review methodology

A qualitative research methodology was adopted in the form of a critical review. Wakefield (2015) and Mpofu (2021b) posit that researchers can review previous studies, analyse them, collate their findings and identify gaps, inconsistencies and consistencies as well as areas of further research in a critical review. Literature was reviewed until the saturation point was reached. Mpofu (2021c) explains saturation point in interviews as the point where further interviewing does not yield any other new information. In this review, it was the point where no new information arose from further reviewing of related literature. A total of 42 articles were reviewed. The search terms used include "AI in tax administration in developing countries", "Challenges of deploying AI in tax administration in developing countries", "Opportunities from the deployment of AI in tax administration in developing countries" and "Implications of using AI in tax administration in developing countries". The review protocol is given in Figure 1.

Figure 1. Review Protocol Adopted
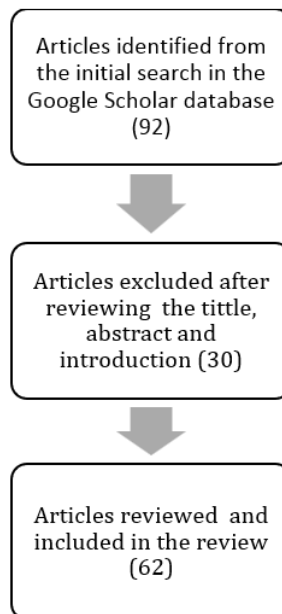
Source: Author's Compilation

Literature review

AI has the likelihood of revolutionising tax administration globally and more so in developing countries where tax compliance is low yet effective domestic revenue mobilisation is critical (Mpofu, 2021a). AI can be used to improve the efficiency and effectiveness of tax administration in developing economies (Deloitte, 2019). It can be used to automate tax administration tasks such as taxpayer identification and registration, computation of tax liability, enforcement and management of tax compliance as well as the identification of tax evaders and detection of fraudulent transactions. This could reduce the costs of tax collection and enforcement, prevent and detect tax evasion and unethical tax avoidance as well as enhance tax compliance in developing countries. According to the OECD (2022a), AI could allow for digital transformation in tax administration, enhance service delivery, reduce tax compliance burdens, and increase tax revenue mobilisation if employed in tax administration. This section reviews the literature unpacking the areas of agreement and divergence among researchers on the prospects of AI adoption in tax administration in developing economies.

AI in tax administration in developing countries

AI can be used to address tax administration weaknesses and challenges faced by tax administration in developing countries. For example, when focusing on transfer pricing manipulation in developing countries, Wealth et al. (2023) point to weak tax administration institutions, inadequate capacity, corruption, poor technologies and lack of technical capacity to fully enforce tax legislation as some of the constraints to productive tax administration. Through Robotic Process Automation (RPA), AI Robots can be used as tax auditors in audit risk assessments, identifying misstatements, errors and fraud, categorising transactions and accounts as well as in proposing better tax liability and enforcement strategies (Huang, 2018). Murorunkwere et al. (2022) allude to the likelihood of fraud detection through the use of neural works. There are several possibilities of deploying AI in tax administration that developing countries could explore. Artificial intelligence is quickly transforming tax administration operations globally and developing countries are no exception (Susar & Aquaro, 2019; Zafar & Villeneuve, 2018). In affirmation Serrano Antón (2021) avers that the deployment of AI in tax administration could fundamentally transform tax administration procedures, enhance efficiency and transparency while availing new opportunities to implement data driven tax revenue mobilisation, automate

certain repetitive tax administration processes, strengthen the fight against tax evasion and avoidance and reducing information asymmetry. AI can be used also in tax audits and segmentation of taxpayers (Rahayu, 2021). The researcher further underscores the need to always ensure ethical and responsible implementation and use of AI in tax administration. This entails upholding the rights, privacy and confidentiality of taxpayers and protecting their information (Serrano Antón, 2021). Figure 2 shows some of the AI technologies that can be harnessed for tax administration purposes.

Figure 2. AI technologies
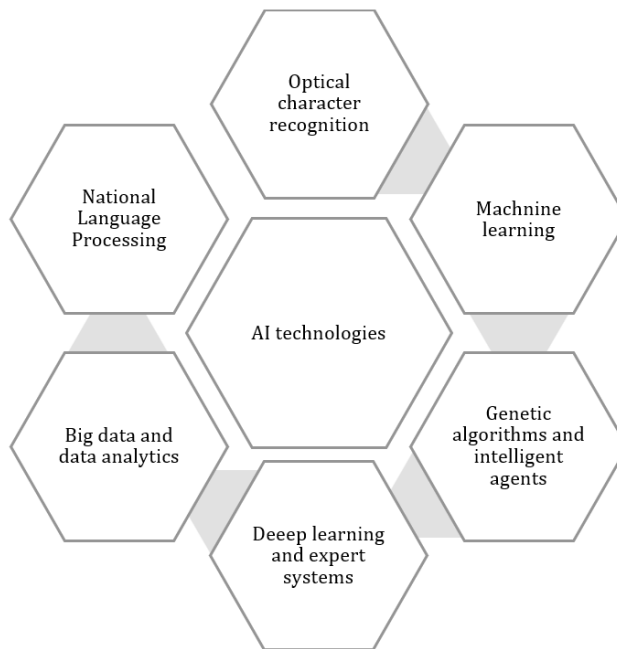
Source: Author's Compilation

Deep learning is a form of machine learning that employs artificial neural works to learn from data. Deep learning technology can be used in the evaluation of contracts such as lease agreements, legal agreements, purchase and disposal contracts as well as mergers and acquisitions (Mpofu, 2023a). These contractual documents have different impacts on tax heads such as corporate tax, value-added tax (VAT), capital gains, and customs duty where assets have been purchased from outside the country. For example, lease agreements could affect

the gross income and allowable deductions depending on whether the taxpayer is the lessor or lessee respectively (Zimbabwe Income Tax Act, Chapter 23: 06 Sections 8 (1) (d) and (e) and 15 (2) d and e). Disposal of a capital asset such as buildings could affect the capital gains tax (Capital Gains Tax Act, Chapter 23: 01). Deep learning could be used to extract and analyse information from the different contracts (Mpofu, 2023b) and objectively show their tax implications. Deep learning can enhance tax administration in the identification of potential tax evasion, automation of tax compliance tasks, provision of personalised service, and foster efficiency and effectiveness in tax administration. Issues of data bias, data availability and explanation of deep learning-driven outcomes and decisions remain problematic. The deployment of AI technology enables the development of audit-oriented novel forecasting and statistical models. AI assists in the prevention and detection of fraud and can also strengthen government control and supervision.

Expert learning systems are a form of AI that can utilised to enhance tax administration. These systems could be trained on a substantial dataset of tax legislation and case law. Additionally, the systems could be used to respond to questions on tax policy based on legislation and case law (Kumar et al., 2023). The expert learning systems could also be used to improve the accuracy of the information, improve communication and response time to queries by the tax authority to stakeholders, provide tax advice to taxpayers, and reduce tax evasion. Commenting on the deployment of an ML/AI-supported tax assessment in India, Kumar et al. (2023) state "Expert systems have been found to offer users a significant amount of control over how they search for solutions, freedom to choose whether to follow system recommendations, and a decrease in the need for supervision". Tax systems seem to allow for more independent work to be conducted, more quick decisions to be made, and a wider range of issues to be addressed. An important source of public funding in a developing country like India is taxes.

Machine learning is a type of AI technology that uses software applications to learn from historical data to make future predictions (Bao et al., 2020). Machine learning uses models and algorithms to conduct data analysis to show trends and patterns and make forecasts. Machine learning uses mathematical formulas and can do classifications and cluster analysis (Dickey et al., 2019). Blanco (2022) posits that AI systems and algorithms must be well-designed and quality data used. This is to ensure adherence to tax principles. Mpofu & Moloi (2022) emphasise the importance of tax administration that adheres to the canons of taxation such as economy, convenience, certainty, simplicity and transparency.

Natural Language Processing deals with the interaction between human language and computers (Moloi & Marwala, 2021b). Natural language processing can be employed in tax administration for the extraction of information from unstructured data such as emails, social media and tax returns, understanding the intentions of taxpayers and automation of certain tax administration functions.

Issa et al. (2016) adduce that AI can be used in the audit function for risk assessments, classifications, application of algorithms, and other audit functions. Equally revenue authority auditors could employ AI in their tax audits in the re-computation of taxable income and tax liability as well as getting insights into the behaviour of taxpayers by assessing the financial and bank transactions. Allami et al. (2022) argue that AI technologies promote objectivity, speed and accuracy in computations and assessment of large volumes of data. While acknowledging these potential opportunities of AI, Landers & Behrend (2022) point out that fairness and bias concerns must always be considered. Instead of sampling transactions due to manual audit techniques, using AI tax auditors could test 100% of transactions.

Despite the potential advantages linked to the use of AI, Aksoy & Gurol (2021) point to the inherent limitations associated with the use of AI. These limitations border around the complexity of AI technology, lack of AI skills, lack of trust and general uncertainties (Fügener et al., 2021). Other researchers raise the issue of biases such as anchoring, availability, confirmation and overconfidence as well as algorithm aversion biases (Commerford et al., 2022; Dickey et al., 2019; Dietvorst & Bharti, 2020).

Focusing on AI in tax administration in Indonesia Saragih et al. (2022) established that applying AI in the discipline of taxation can help revenue authorities in the enforcement of tax legislation, enhance the principle of convenience in the settlement of tax obligations by taxpayers, build justice for taxpayers and minimise tax compliance expenses. The lack of appropriate regulations governing AI applications, as well as the inadequacy of human resources with AI knowledge to gather and process data, and the lack of digital infrastructure are the constraints to implementing AI to modernize tax administration functions in Indonesia.

Kamil (2022) found out that "Artificial Intelligence Technology for Income Tax E-Filling has a significant positive effect on Tax Compliance". While focusing on the use of technologies such as AI in tax administration Granger et al. (2022) point to the importance of the implications concerning the capabilities of tax administrators, tax consultants, taxpayers, and accountants. The researchers further highlight AI adoption discussions should also focus on legal and ethical considerations, capacity challenges, and possible opportunities as well as data

governance matters. On a positive note, Granger et al. (2022) posit that by using AI, revenue authorities could "tap seamlessly into the digital footprints of people and businesses" to mobilise tax revenue.

Opportunities and positive implications of harnessing AI in tax administration in developing countries

Researchers argue that AI is likely to have consequential positive implications on tax administration in developing countries (Pica, 2023; Zhang, 2020). These gains include the possibility of automating the registration for tax process, improving tax compliance, improving domestic revenue mobilisation and an increase in tax revenue. An increase in efficiency, accuracy and transparency in tax administration, reduction in tax administration and compliance costs. AI can enable revenue authorities to address tax compliance challenges such as the understatement and concealing of incomes, understatement of tax liability as well as other fraudulent activities are some of the advantages of using AI in tax administration. AI can also be directed towards the enhancement of enforcement activities. Affirming the advantages of deploying AI in tax administration, Collosa (2020) propounds that in tax administration AI can be used to project revenue collections, risk analysis, detection of fraud patterns, audit purposes and optical facial recognition in customs. All these AI functions could lead to an increase in tax revenue. Some of the anticipated advantages are discussed in the subsections.

a) Taxpayer identification

AI can be utilised to identify unregistered potential taxpayers through the analysis of their personal and financial data. AI can be used to address the challenge of informality to tax administration in developing countries (Twesige et al., 2020). Informality is one of the key challenges to domestic revenue mobilisation (Mpofu, 2021b). AI could be used in the identification of informal businesses for tax purposes, by analysing data from different sources such as land records, financial transactions, mobile money transactions and social media information. This could help revenue administrators to direct their tax compliance efforts more effectively. Furthermore, AI can be employed to assist mobile tax revenue mobilisation which could be convenient and ideal for informal businesses. This could broaden the tax base and increase tax compliance while minimising both the tax administration and compliance costs for revenue authorities and taxpayers respectively (UNDP, 2022). Additionally, AI can be utilised to conduct outreach and educational programs to educate informal

businesses about their tax obligations, how to comply and complete tax returns as well as the benefits of being tax compliant. This could improve tax literacy, enhance taxpayer education and awareness as well as compliance in the informal economy. Concerning enhancing tax compliance in the informal economy the UNDP (2022) adduces "The MSMEs can be identified through big data sources, including national identification number, driving licenses, bank details, utility bills and digital (mobile) transactions. Following that, big data analytics can be conducted to provide details of their whereabouts, value chain and monthly average spending''. MSMEs in the quotation thus referring to Micro Small and Medium Enterprises.

b) Computation of tax liability

Heavily investing in human-oriented administrative matters increases human-to-human interactions in tax administration thus opening crevices for abuse of tax legislation and corruption. This causes a lack of trust in government by taxpayers and impairs the implicit social contract (Mpofu, 2021b). Due to the use of presumptions in the computation of tax liability in most African countries when assessing the tax obligation of small business, trust between taxpayers and tax officials has been eroded. The UNDP (2022) alludes to the loss of trust in tax computations by Tanzanian MSMEs because of the estimation of revenue challenges. The report further states that the manual nature of tax administration is associated with significant cost implications, human capital requirements and assessment delays. Digitalization, AI adoption and the application of big data and data analytics could reduce mistrust, corruption, human interactions and make tax administration more transparent (UNDP, 2022).

The use of AI in tax administration in developing countries could improve accuracy and transparency in the assessment of tax liability. Instead of tax liability assessment being conducted manually, through big data analytics and machine learning taxpayer information is collected easily and quickly. Taxpayer information could also be analysed with a high degree of accuracy. This could improve the accuracy of tax liability assessment, reduce the risk of errors and omissions while enhancing the cogency of tax compliance checks. This could reduce tax disputes.

c) Strengthening tax audits and detection of fraudulent transactions

AI technologies can be used to strengthen tax audits and improve the prevention and detection of fraudulent transactions and income from illegal activities. AI can be applied to trace and detect fraudulent activities following

the digital footprints of incomes and payments. Such transactions could involve money laundering and other schemes used to clean "dirty money" and channel it into the mainstream financial system. This could lead to the combating of tax avoidance and financial crimes thus leading to the recovery of lost tax revenues and the protection of the economy, taxpayers and the public from the negative consequences associated with revenue leakages. Additionally, AI provides simulated tax risks, which can help more complex human judgments to be made. AI can also aid detection of fraud, contributing to its supervision and monitoring by government. The development of AI continues, and its deployment has certain limits and risks that must be recognized (Huang, 2018). The application of AI allows data organisation and tax collections to be more transparent and systematic, thus assisting revenue authorities in developing countries to reduce excessive and unethical tax avoidance, address illegal tax evasion and deal with aggressive transfer pricing and tax base erosion perpetuated by multinational enterprises in developing countries. The persistent problem of aggressive transfer pricing and tax evasion by multinational companies is attributed to weak tax administration systems in developing countries and the opaqueness of transactions done by these companies (Mpofu & Wealth, 2022). Applying AI to streamline tax data by the government increases efficiency and compliance with current policies on tax reporting and reasonable tax avoidance. In addition, to heightening efficiency and solidifying the effectiveness of tax administration, the deployment of AI can help build mathematical tax models, assess tax trends and economic performance indicators, identify and analyse tax challenges faced by corporate and individual taxpayers and review tax policy accordingly. In dealing with transfer pricing, base erosion and profit shifting as well as tax avoidance in developing countries, Mpofu (2022b) advocates for the strengthening of tax administration in developing countries, through the harnessing of technology, training and research. Consequently, by adopting AI tax administrators could diagnose the reasons for non-tax compliance more appropriately, where be it tax evasion or aggressive tax avoidance or poor performance linked to economic challenges (Huang, 2018). This would not only strengthen tax administration but also enable tax compliance constraints to be identified and addressed accordingly to maximise tax revenue generation with suffocating companies with overly burdensome tax rates.

d) Enhancing enforcement and tax compliance

To achieve the following three objectives of effective tax administration, which are (1) a high level of voluntary compliance, (2) a high level of trust in tax administration, and (3) a high level of productivity among tax officers,

Santiso (2022) calls for synergy in digital tax reforms and anticorruption strategies in developing countries. Corruption is one of the fundamental impediments to effective revenue mobilisation and the attainment of SDGs in developing countries. Digital tax reforms could reduce corruption, improve tax compliance and enhance SDG16 on peace, justice and the creation of strong institutions. AI-powered tax administration platforms could help improve tax administration enforcement and compliance (Hassan, 2023; Huang, 2018). For example, by automating some of the repetitive tax such as taxpayer registration and information dissemination. Sending reminders to taxpayers to tax lodge returns, the processing of returns and resolution of tax disputes, time can be freed for other activities. Tasks such as the identification of potential tax evaders, assessing, preventing and detecting fraud as well as other tax compliance-oriented tasks could be delegated to machines. This could lead to a reduction in the workload of tax officers, allowing them to dedicate their attention to other intricate tasks, thus enhancing the efficiency of tax administration systems. By tracking the flow of revenue and easily identifying potential revenue leakages and loopholes, AI-supported tax administration platforms, promote fairness and transparency in tax administration. Thus promoting tax justice which is one of the drivers of tax compliance. AI can also lead to a reduction in costs of tax administration and compliance. Through technologies such as robotic proves automation, by automating repetitive tasks and eliminating areas of redundancy, labour costs could be reduced for both the revenue authority and taxpayers (Hassan, 2023). Automation could also free up resources that could be dedicated to improving other tax administration services.

e) Mitigation of tax avoidance schemes

Tax evasion and aggressive tax avoidance through transfer pricing and other tax planning ways are considered some of the fundamental reasons for the low tax-to-GDP ratio in developing countries (Mpofu, 2022b). By using machine learning technology, AI can be used to analyse large volumes of data that would generally be daunting to effectively analyse and pick trends manually. Through this quick and effective analysis using machine learning algorithms, revenue authorities could detect patterns and suspicious transactions that might point to tax evasion schemes. When dealing with digital technology it is easier to diagnose faults and weaknesses in the tax administration system. AI technologies are impartial, transparent, accurate, user-friendly, and efficient, which might encourage tax compliance and minimise revenue offers' aggressive behaviour towards taxpayers (UNDP, 2022). This might smoothen the antagonistic relationship between taxpayers and tax officers. The use of AI and big data culminate in increased tax revenue and compliance. The deployment of AI is likely to offer linkages and foster the exchange of information between tax

administration functions, tax administration authorities, government agencies and departments as well as the private sector such as mobile money operators and digital payments service providers. Consequently, the use of AI might lead to improved tax compliance and increased tax revenue. Currently, because of the weaknesses associated with manual functions in most tax administration authorities in developing countries tax authorities dedicate most resources toward strengthening enforcement to combat tax evasion and avoidance as opposed to building a conducive environment to promote voluntary tax compliance. Aggressive enforcement leads to low tax morale and increased non-tax compliance in some cases (Sebele-Mpofu, 2020, 2021). AI usage can help prevent tax evasion and unethical tax avoidance. AI and big data offer a solution to the afore-mentioned challenges by instilling systems to detect and counter such practices". While acknowledging the likelihood of enhanced risk management and reduction in tax evasion cases through the use of AI technologies, Binder (2019) argues that the use machine learning algorithms could result in biases or errors in AI-supported risk assessments. The researcher further points to control and complexity as some of the AI associated challenges in risk management practices.

f) Improving communication and decision-making

Ihnatišinová (2021) argues, "Artificial intelligence technology creates new digital communication channels and contributes to more efficient paperless tax administration". The global trend of digital communication involves chatbots, digital assistants and voice bots. This significantly enhances communication, making it easier and faster. This could strengthen tax administration as queries, complaints and questions are attended to timeously. The interaction between taxpayers and tax administrators is made smooth and less of face to face interaction that often lead to intimidation and corruption. Holmes (2017) and Pica (2023) posit that while AI is able to learn from the personal data that it processes through technologies such natural language processing and machine learning it can give deeper insights concerning the data being processed. This could help tax administration authorities attain their goals, set new ones and improve decision-making.

Challenges and negative implications associated with AI in tax administration in developing countries

Even though the use of AI in tax administration in developing countries heralds a lot of opportunities and positive implications, several challenges need to be addressed. To ensure AI is effectively harnessed to improve tax administration, enforcement and compliance as well as ultimately broaden

domestic revenue mobilisation in developing countries, governments and their revenue authorities need to deal with the possible constraints and negative externalities. These potential constraints include the digital divide, illiteracy challenges, lack of technical expertise, limited financial resources, data availability challenges, informality and legislative as well as regulatory challenges and ethical implications. Summarising the risks of AI implementation, Collosa (2020) groups them into intrinsic risks (related to the data), and extrinsic risks (associated with AI adoption in society). Intrinsic risks have to be considered to ensure fairness and inclusiveness, privacy and security of data, transparency and accountability as well as security and reliability. These have to be incorporated at all stages of AI development and deployment. Extrinsic implications focus on what AI holds for the future. For example, the OECD (2019a) emphasises that AI adoption should result in sustainable development, and inclusive growth and promote the social well-being of people. Therefore, understanding the challenges that could hinder the fruition of these expectations is crucial in addition to the possible positive and negative consequences.

a) The digital divide and lack of technical expertise

Tax consultants and accounts generally used advanced technologies and automated programs in their tax advisory work (Pavlova & Knyazeva, 2021). While these tax professionals might find their communication and engagements with tax administration authorities improved, for ordinary taxpayers such as sole traders, small scale miners, informal traders and small and medium enterprises might lack the special digital competencies to interact with AI-based tax administration systems. The platforms powered by AI can be complicated to use. Due to the complexity of these platforms and the general digital divide in most developing countries, taxpayers may face challenges in using these platforms. This might lead to a digital divide in non-tax compliance or tax avoidance, thus reducing tax revenue mobilisation. Mhlanga & Ndhlovu (2023) points out that while emerging economies are embracing the 4IR technologies they are doing so at a slow pace as compared to developed countries. Therefore, in some developing countries, there might be a digital or technical expertise gap, and there might be a shortage of expertise to implement and operate AI-supported tax administration platforms. According to Mpofu (2023a) generally, most developing countries have technical expertise or skills gaps and more so in the public sector. Consequent to poor remuneration in the public sector, revenue authorities in developing countries struggle to attract and retain those with the relevant and requisite skills to implement AI in tax administration.

b) Limited financial resources

The adoption of new technology is often connected to significant capital requirements. Companies need to have large amounts of money to invest in digital equipment and software. Therefore, AI-powered platforms might be expensive to develop and launch. Many developing countries often suffer from limited financial resources due to weak revenue domestic mobilisation, porous tax administration systems, tax avoidance and corruption among other factors (Wealth et al., 2023). The budget for tax administration authorities might be limited and inadequate to fund substantial expenditures and other costs associated with the development and deployment of AI-supported platforms. The limited resources might also make it difficult to invest in AI or technology-oriented human capital development and training.

c) Legal and regulatory challenges

While the adoption of AI has received significant attention and the developments in AI are moving with great speed, the formulation regulatory frameworks to govern the use of AI is slow paced especially in developing countries (Mpofu, 2023a). Some developing countries might experience legislative and regulatory challenges relating to the utilisation of AI technologies in tax administration. These regulatory problems have implications for tax audits and tax dispute resolutions. These challenges need to be considered to ensure the effective, ethical and responsible application of AI in tax administration.

d) Informality

The informal economy is one of the fundamental challenges of revenue authorities in developing countries. The informal economy contributes very little to developing economies yet the sector contributes substantially to the Gross Domestic Product (GDP) of these economies (Sebele-Mpofu, 2020; Mpofu, 2021a). It is challenging to mobilise tax revenue from the informal economy because the economy is a cash economy characterised by unregistered businesses, mobile businesses, lack of information and transparency (Rogan, 2019). Considering AI systems are dependent on the availability of data and the quality of data used for training the AI-powered system, it might be challenging to get the data from the informal economy.

AI technology could be applied to the tax administration of Micro Small and Medium Enterprises (MSMEs). The technologies can be used to track the mobility of MSMEs, improve the record keeping of their transactions especially those using mobile money services, link them to buyers and sellers, and trace their transactions (UNDP, 2022). Furthermore, by using AI to identify MSMEs,

they can be assisted to formalise, mage and grow their businesses better as well as enable them to access government services and financial services. This could improve tax administration, tax compliance and tax revenue generation from the informal sector. As posited by the UNDP (2022):

"The investment that goes into tax collection and administration systems, instead of automating the systems, specifically results in enforcing compliance without necessarily increasing tax collections. For instance, most of the countries are injecting their resources into activities such as tax audits, tax evasion and fraud detection as well as adding pressure on noncompliant taxpayers to increase tax revenue though in reality, they raise the administration costs without any significant additions to the collections".

Therefore, whether AI-supported tax administration would help in increasing tax compliance in the informal sector or just increase costs in investing in technologies depends on several factors. For example, the use of digital financial services such as mobile money in the African countries could improve tax collections from the informal sector.

e) Resistance to change

Considering that technology may be both transformative and disruptive, there may be resistance to change to AI-supported tax administration by employees and taxpayers. Millan Vargas & Sandoval-Almazán (2024) and Mpofu (2024) allude to the resistance to change as big challenge in the implantation of digital technologies in public administration.Tax officials who are comfortable with the conventional methods of tax administration may not be open to modern ways of tax administration. Therefore, they can resist change and may be unwilling to embrace AI.

f) Lack of political will and corruption

In some developing countries, there may be no political will to invest in AI-supported tax administration systems. This could be linked to the abuse of tax systems by the politically connected in most African countries. AI systems might limit changes of circumventing tax regulations and corruption. The government may also not give the necessary commitment and support to tax administration authorities in the form of financial and technical resources needed for the development and deployment of AI-powered tax administration. This might cripple the adoption of AI. In some cases, even where adequate or substantial financial resources have been dedicated to AI projects, corruption could impede the implementation of AI in tax administration. In most African

countries, corruption is a big issue in government projects where funds are embezzled, there is poor workmanship, or projects are left uncompleted when funds have been misused or diverted and costs are overstated.

g) Data availability constraints

AI-supported platforms and activities generally depend on large volumes of data to train and operate some machines. While this data could be collected using AI technologies such as big data and data analytics, in some developing countries data availability may be a big constraint, especially in African countries where the degrees of informality are very high. The informal sector is observed to be characterised by low levels of tax compliance, poor record keeping, and at times low levels of digital, tax and financial literacy. The sector is viewed as a cash economy (Mpofu, 2021c; Sebele-Mpofu & Moyo, 2021).

h) Changing tax policy

Tax policy is generally evolving, constantly being updated and revised, and accordingly, this will require that AI applications employed in tax administration are updated and amended to respond to new tax legislation and new risks emerging from the dynamism of the business environment (Huang, 2018). Consequently, AI systems would have to be improved to produce accurate outcomes. Ensuring that the AI systems remain abreast with the changes in tax policy requires financial resources and technical expertise, which are lacking in developing countries. Additionally, considering AI adoption is still in its infancy in developing countries, and the AI system will have to be updated manually, this might affect the effectiveness of the system.

Case studies on the use of AI in Tax Administration in Developed and Developing Countries

This section gives an insight brief into some of the developed countries that have employed AI in tax administration. The section also provides a summary of case studies of developing countries that have adopted AI in tax administration in developing countries. The case studies give an insight into the motivations for harnessing AI in tax administration as well as to accentuate the possible benefits, challenges, and implications of applying AI technologies in tax administration developing countries.

Sweden harnessed AI in taxpayer registration from May 2021. Categorisation of taxpayers is done digitally thus saving time. The registration process has shortened the registration time and reduced the costs of registration by an estimated 16% of the total costs of the process. France also uses machine learning algorithms to detect hidden or undeclared developments and constructions, as well as to check whether taxpayers pay the correct tax, specifically real estate taxes. Countries such as Canada, Australia, Finland, the United Kingdom and Ireland among others use virtual assistants and chatbots to provide personalised services to taxpayers. In Canada, CRA is making use of machine learning, natural language processing, and data visualisation packages to digitally transform the accessing, processing, and data analysis. The revenue authority has also offered training to empower the accounting profession to harness AI and data analytics. The tax authority of Singapore uses AI across all tax administration functions to improve tax compliance and service provisioning to taxpayers (through service quality monitoring using live chats and natural language processing models). AI has increased productivity and objectivity in tax administration by using feedback from live chats to enhance the tax system (Collosa, 2022). CRA could quickly responded to the COVID-19 pandemic, by exploiting their digital readiness to continue interacting and offering services to taxpayers and the government (OECD, 2022a). While AI technologies are greatly used in developed countries in taxation, Owens & Schlenther (2022) submit that several countries in Africa are adopting digital technologies in their tax systems to boost domestic revenue mobilisation.

Van Rooi (2023) gives examples of Rwanda, South Africa and India as some of the countries that have harnessed the 4IR technologies in their tax administration systems. While focusing on the levels of adoption and usage of the 4IR technologies in some countries in both the developed and developing contexts, Adams (2022) ranked these countries based on certain performance measures according to the achievement criteria (achieved, partially achieved and not achieved). In terms of gaining awareness, fostering positive attitudes and perceptions towards 4IR technologies adoption, India, Rwanda and South Africa were ranked to have achieved this. On the use and effectiveness of using 4IR tools in taxation, Rwanda was ranked as having achieved, while India and South Africa as having partially achieved this goal (Adams, 2022; Van Rooi, 2023). Julius & Christabel (2020) adduce that the East African community uses the Regional Electronic Cargo Tracking System (RECTS) to monitor the cargo that is transported from Kenya through to countries such as Uganda, Rwanda and the democratic Republic of Congo.

This study looked at South Africa, India, Kenya, Indonesia, Rwanda, Nigeria and Mexico as some of the developing countries that have applied AI

technologies in their tax administration functions. While the countries share some commonalities in terms of opportunities, challenges and implications associated with AI-driven tax administration, differences also exist in these three areas due to the variations in the level of development as well as economic, political, social and legal differences in the contextual environments.

South Africa

According to the South African Institute of Public Accountants (SAIPA) (2021) and South African Revenue Services (SARS) (2021) adduce that SARs was integrating the 4IR technologies into the tax system. While South Africa Revenue Services (SARS) launched an AI-driven tax administration platform to improve tax compliance in the country. The platform utilises machine learning to analyse data collected from taxpayers' records and pinpoint potential disparities or suspicious trends (Moodley, 2024). Quoting the SARS commissioner, the author observed that while using AI, data analytics and other proactive risk management measures SARS was able to recover approximately R210 billion through their activities targeting illicit economic activities and tax evasion. This is pivotal in enforcing tax compliance as well as enhancing efficiency in tax administration. Assessing the impact of employing the 4IR technologies in tax administration in South Africa Van Rooi (2023) identified both favourable and unfavourable outcomes. On the positive side, concerning tax heads such as VAT, personal income tax and corporate tax, the researcher points out that tax system automation improved, e-filling of tax returns, communication with taxpayers, efficiency and tax compliance. On the negative, the researcher further submits that the adoption of the 4IR technologies amplified the associated need for upskilling and reskilling and made evident the possibilities of job losses in the near future.

Kenya

The Kenya Revenue Authority (KRA) introduced an AI-supported platform known as iTax that was employed for the identification of potential tax evaders, thereby improving tax compliance and mitigating tax evasion (Oeta, 2017). Using machine learning iTax analyses data from taxpayers' bank accounts and transactions. This enables the revenue authority to understand the income and expenditure patterns of taxpayers and identify the taxpayers who evade tax or understate their tax liability. Owens & Schlenther (2022) portend that AI can be used for risk management, deploy data analytics to drive targeted, tax compliance, profile taxpayers and enhance tax compliance product and resource optimisation. Akinrinola et al. (2024) adduces that while there is

progress in automation of tax administration processes, gaps are still evident in statistical analysis and large volumes of data, data quality and tax compliance. Therefore, it is imperative to understand the progress, opportunities and the likely barriers of applying the 4IR technologies in tax administration in Africa

Indonesia

Indonesia is one of the countries that have made progress towards harnessing Artificial Intelligence (AI) to strengthen tax administration functions (Nugraha, 2023; Saragih et al., 2023). The AI-supported platform known as DJP-AI is used for the identification of fraudulent activities. The AI-backed platform utilises machine learning in the analysis of taxpayers' data extracted from tax returns and other transactions of the taxpayer. This enhances tax administration, reduces tax evasion and increases tax compliance. Nugraha (2023) states that some of the positive outcomes that emanated from infusing AI into tax administration relate to better compliance analysis and targeted taxpayer support as well as monitoring. Lastly, the limited AI adoption and usage was linked to lack of awareness and regulations gaps, pointing to an exigent need for continuous endeavours to enhance AI-based tax administration (Nugraha, 2023). When studying AI-based tax administration in Indonesia, Saragih et al. (2023) found that AI improved tax administration enforcement, convenience in filing tax returns and tax justice and lowered the tax compliance costs. Consequently, this boosted domestic revenue mobilisation. The progress of the Indonesia in integrating AI in tax administration system modernisation is attributed to the commitment to support technological developments by national government as shown by the AI National strategy. Challenges to effective deployment of AI in tax administration in Indonesia were identified to include the lack of clear regulations for the governance of AI adoption, lack of AI skilled personnel, attitudes towards digital transformation, unavailability of data to support AI models as well as the lack of adequate and modern digital infrastructure (Saragih et al., 2023). Therefore, to address the above challenges it is imperative improve the quality of data, provide support for integrating AI in taxation through training and awareness programs for tax officials and taxpayers as well as the improvement of data quality.

India

Rathi et al. (2021) observe that the Indian government announced its intention integrate AI and machine learnin in tax administration activities. Saragih et al. (2023) adduce that India and Malaysia have adopted AI-driven platforms in managing tax compliance. The Indian tax system uses machine

learning for analysing data from the records of taxpayers. Chatbots are also used to communicate with taxpayers and other stakeholders while RPA has been applied to digitally carry out some repetitive tasks. In concurrence, Shakil & Tasnia (2022) portend that India is using AI in the administration of the goods and services tax as well as in carrying out e-audits. This helps foster tax compliance. While studying the influence of factors such as tax system complexity, tax education and knowledge, perceived fairness, taxpayer attitudes and perceptions on the adoption of AI in tax administration, Rathi et al. (2021) observe that while the tax authority has made progress in applying AI technologies in tax input data, data processing and decision making, there was a gap in taxpayer education and awareness towards AI. The researchers recommended comprehensive AI and tax education and awareness programs to build trust and acceptance of AI as a tool to ensure tax justice, accountability and transparency in taxation.

Nigeria

In Nigeria, the Federal Inland Revenue Services (FIRS) is working on an AI-powered digital platform. This platform could be employed to detect fraudulent transactions. The platform is expected to use machine learning to analyse data from the tax returns submitted by taxpayers and other transactions done by taxpayers. Kifordu (2021) is of the view that the adoption of machine learning in Nigeria could help minimise tax fraud and corruption. The researcher further avers that while machine learning presents great opportunities for tax revenue forecasting such as enhanced accuracy, challenges such ethical considerations. Model interpretability and data complexity threaten the potential to reap the envisaged benefits. The objective is to assist the FIRS minimise tax evasion, recovering any revenue lost through tax evasion, and protecting taxpayers from financial losses.

Mexico

Mexico is another country applying AI in tax administration using machine learning for the analysis of taxpayers' bank accounts and transactions. This gives authorities some insights into the income that accrues to the taxpayer. Tax officials can assess whether the taxpayer pays the correct tax liability. This minimises instances of tax avoidance (Zumaya et al., 2021; Junquera-Varela et al., 2022). Artificial neural works and machine learning are used for forecasting fraud detection, risk assessment and in the identification of patterns by tax evaders. Therefore, these technologies could also be useful in identifying money laundering, corruption, bribery and other financial crimes or

illicit financial flows. These ills negatively impact domestic revenue mobilisation in developing countries and sustainable development efforts. Wealth et al. (2023) points to the loss of revenue due to aggressive transfer pricing in Africa and Zimbabwe in particular. Zumaya et al. (2021) call for caution to be applied in the use of these technologies as they have both strengths and limitations. Strengths include the ability to use sophisticated statistical methods, processing large data sets and the increased speed and accuracy at which certain tasks could completed. Overconfidence in the potential impact of these technologies in transforming several facets of businesses and daily lives has led to their limitations not being properly and comprehensively defined. Challenges include lack of skills, limited comprehension of AI technologies. This suggests the need to develop competencies. Consequently, research that situates the opportunities and risks of these technologies developed and developing contexts is critical

Rwanda

The Rwanda Revenue Authority (RRA) adopted an AI-driven system that is employed improve tax, registration, filling of tax returns and declarations, for settling tax liability obligations and to identify potential tax evasion and fraud using natural language processing. Describing the use of AI technologies in taxation in Rwanda, Twesige et al. (2020) refers to it as smart taxation. When assessing how smart taxation affected tax compliance in Rwanda, the researchers established that there was a strong and positive association between smart taxation and tax compliance. Twesige et al. (2020) further suggest that training for both taxpayers and RRA employees on digital skills to enable them to effectively embrace the new technological advancements and developments emerging in the 4IR.

Julius & Christabel (2020) portend that that the East African community uses the Regional Electronic Cargo Tracking System (RECTS) to monitor cargo that is in transit from Kenya through countries such as Uganda, Rwanda and the Democratic Republic of Congo. AI has the potential to revolutionise customs operations and increase revenue mobilisation through customs duties. The researchers further conclude that Public Private Partnerships (PPPs), having a clear change management strategy and combining RECTS with other customs systems, together with the development of digital skills for tax offers would strengthen digital transformation in the East African countries. Julius & Christabel (2020) further submit that machine learning, data mining and AI could contribute significantly to reducing tax fraud. The researchers found out that AI neural works were able to identify tax fraud with an accuracy of 92%, a

precision of 85% and a recall score of 99% in Rwanda. Therefore, these arguments point to great possibilities for minimising tax avoidance and evasion in developing countries through the deployment of AI in tax administration.

In a nut shell, above case studies are just some of the selected examples of developing countries that have adopted AI or are working toward harnessing AI in tax administration. With technological advancements, digital transformation, the evolving business world, the expanding digital economy, the evolution of money and the birth of digital currencies such as bitcoin and central bank digital currencies (CBDCs).

Implications of Using AI in Tax Administration in Developing Countries

The OECD (2019a) suggests five principles that must govern the implementation. These are prudence, no-discrimination, proportionality, transparency and data governance principles. The principle of prudence focuses on the complexity of AI technologies as such the principle advocates for pilot tests or smaller-scale adoption of AI before wide-scale adoption. Cost-benefit analysis is also critical considering AI adoption requires significant financial investment. The principle of non-discrimination calls for careful consideration of algorithm biases and human errors that might lead to discrimination or unfair treatment. The principle of proportionality concerns the rights and guarantees of taxpayers versus the AI applications and decisions derived from AI technology outcomes. The principle of transparency concerns allowing taxpayers access to information for example about why a certain decision is made, be it reassessment of tax liability or levying penalties. In this case, the question is, are revenue authorities willing to give taxpayers access to the algorithms and information used and the processing parameters among other things? Lastly, the data governance principle relates to the security of data, how confidentiality and how the privacy of taxpayers is protected and respected (OECD, 2019a). How data privacy and confidentiality is protected and ensured respectively can affect technology acceptance by users and taxpayers in this case. This consequently points to several implications for taxpayers.

a) Ethical implications

Additional to the challenges associated with AI in tax administration, it is also pivotal to highlight the possible ethical implications connected with the adoption of these technologies. When applying AI in tax administration it is

important to note that large volumes of data concerning taxpayers would be collected. How this data is collected, stored and used is very essential as some of the data concerns personal information, activities and incomes of taxpayers. If the data is not ethically and responsibly used or securely stored and protected it can be wrongfully accessed and used to the taxpayers' detriment (Collosa, 2020, 2022). Developing countries are often characterised by weak privacy and regulations, this raises questions about the ability of revenue authorities to protect the privacy of taxpayers and adequately uphold the principles associated with data collection, storage, and protection. Therefore, revenue authorities need to protect taxpayers' information against abuse, data theft and ensure that the data is not utilised in a way that violates the privacy of taxpayers or discriminates against them. There is also a likelihood of certain job being made redundant as a consequence of harnessing AI in tax administration. As machine learning and AI continue to advance in the future, they will significantly alter the job market in ways that were never envisaged, replacing jobs that are predictable and repeatable with machine supported ones (Agarwal, 2018). Some jobs might be lost, new jobs might emerge and some jobs might need upskilling and re-skilling to be done to augment the interaction between AI and humans in some areas. All this has social, economic, technological, political and legal considerations for developing countries.

b) Risk management implications

By using AI and machine learning in tax administration, tax administrators can be able to manage large data sets and increase the power of technology, opening new avenues for risk management in tax administration. Tax administrators can identify concealed assets, identify new areas of risk and easily identify risks that were previously difficult to define (Collosa, 2022; OECD, 2022b). Notwithstanding the positive implications, negative implications such as the increased risk of cyberattacks, system failure and digital exclusion leading to non-compliance and lack of trust must be considered.

Discussion of findings

The review highlighted the importance of AI in tax administration in developing countries. The findings can be summarised in three important areas. These are the importance of creating a conducive environment for the deployment of AI in tax administration in developing countries, the opportunities and changes of AI-supported tax administration in developing countries, and possible implications for adopting AI in tax administration in developing countries.

Importance of a creating conducive environment for deploying AI

The review established that there is a growing call for AI-powered tax administration in developing countries, yet this overlooks the importance of building an enabling environment for launching AI-driven tax administration. To productively harness AI in tax administration having a conducive environment is irrefutably pivotal. Revenue authorities only successfully deploy AI, engage in digitalisation, or adopt ICT if they have a clear vision and strategy as well as planning as opposed to opportunistic or reactive adoption. The AI adoption plan must have a futuristic digital tax administration adoption roadmap, which takes into consideration available resources and technology, tax legislation, laws and regulations governing technology use, data availability and digital infrastructure among other things. Affirming this observation, the UNDP (2022) recommends:
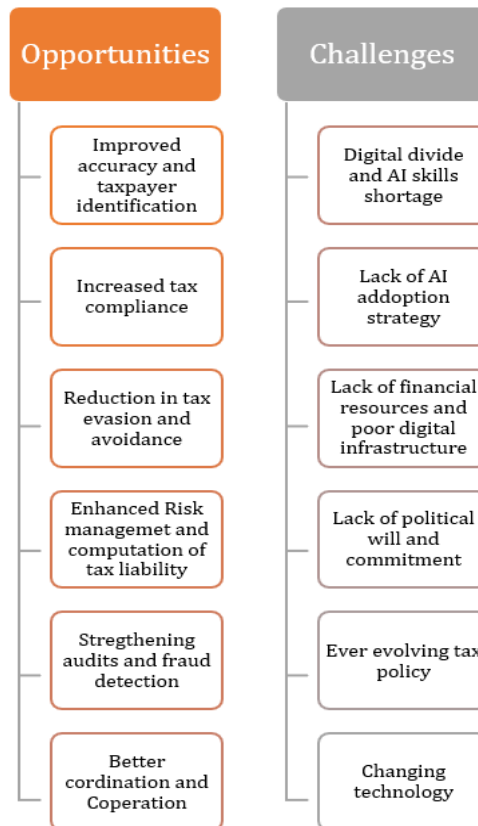
"When developing a roadmap and prior to digitalization, tax, and customs administrations need to declutter the administrative rules, eliminating unnecessary reporting requirements and ensuring that those that are kept would fit into the digital age. It is important to establish strong leadership commitment at the executive level and create governance structures that remove blockages and allow for collaboration, while holding project managers accountable. Ensuring the quality of the data collected and that it is fit-for-purpose and relevant is a key aspect toward effectively digitalizing tax and customs administrations".

Therefore, the next subsections discuss the review findings in relation to opportunities and challenges of AI-driven tax administration as well as the implications and recommendations for improving AI-supported tax administration in developing countries.

Opportunities and challenges of AI-supported tax administration in developing countries

The review identified several opportunities and Challenges connected to adopting AI in tax administration in developing countries some of these are summarised in Figure 3. AI can be used to ameliorate tax administration challenges as well as to model taxpayer behaviour so as to design measures to combat tax fraud or set up contingent plans to address different ways that taxpayers in which taxpayers can respond to AI deployment.

Figure 3. Opportunities and Challenges for AI-driven tax administration
in developing countries

| Opportunities	Challenges
Improved accuracy and taxpayer identification	Digital divide and AI skills shortage
Increased tax compliance	Lack of AI addoption strategy
Reduction in tax evasion and avoidance	Lack of financial resources and poor digital infrastructure
Enhanced Risk managemet and computation of tax liability	Lack of political will and commitment
Stregthening audits and fraud detection	Ever evolving tax policy
Better cordination and Coperation	Changing technology

Source: Author's Compilation

Implications for AI-supported tax administration in developing countries

In this time of the growing digital economy and digital transformation in almost every sector of the economy, to remain relevant and effective in their roles revenue administration authorities must augment their tax administration functions (e- administration for both customs and tax administration) by harnessing information, communication and technology (ICT). The review found that there were various implications both negative and positive linked to the deployment of AI in tax administration requirements. These are also associated with the opportunities and challenges above. The OECD (2019b) in

particular affirmed the importance of understanding the implications for adopting AI technologies in general and tax administration, observing that AI implications need to be assessed from various dimensions such as the ethical, sociological, technological, economic, legal and political dimensions. These implications range from the planning stage, and risk assessment to the implementation, monitoring and post-implementation audit stages. Masseno (2020) posits that one of the pressing ethical challenges associated with using AI in tax administration concerns the probability of remodelling anonymised in the hands of tax administration authorities to reconstruct the personal data of taxpayers, enabling identification of the taxpayer. Cockfield (2010) affirms this concern arguing that taxpayer information in the hands of revenue administration authorities generally encompass sensitive personal information such as income details (amount of income and sources of income), employment status, donations, spending, investment and savings, personal assets, mortgages, child maintenance and alimony, professional and personal club membership fees as well as personal circumstances such as disability and age. This comprehensive personal data may be exploited to reconstruct an in-depth profile of a taxpayers' identity, revealing issues such as religion, political affiliation and other financial behaviour aspects (Cockfield, 2010, 2016).

These implications are summarised in Figure 4. Developing countries need to understand and address these implications to improve the deployment of AI in tax administration.

Figure 4. Implications for AI Adoption in Tax Administration in Developing Countries
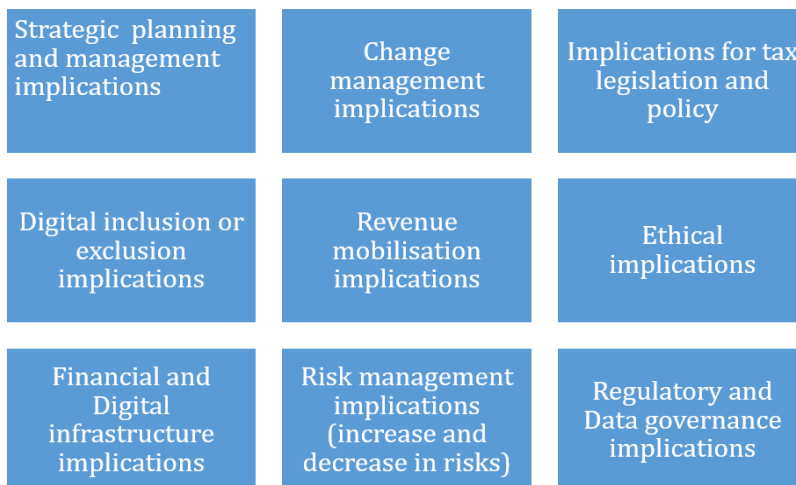
Source: Author's Compilation

A comprehensive understanding of these implications is likely to contribute to the development and deployment of AI in an ethically way and to ensure that AI in tax administration addresses the practical, economic and social implications in line with the needs of the various stakeholders.

Conclusions, limitations, recommendations, and areas of further research

AI is anticipated to be a powerful technology in the digital transformation of tax administration in developing countries. It could be harnessed to improve tax compliance and strengthen domestic revenue mobilisation in developing economies. Additionally, through AI deployment revenue authorities could make tax administration and enforcement more systematic, effective, accurate and transparent. This might also assist in reducing aggressive tax avoidance by multinational enterprises as well as tax evasion through exploitative transfer pricing abuses that lead to base erosion and profit shifting in developing countries. Furthermore, data gathered through AI technologies such a big data can be can be used to design mathematical models through machine learning, assess the tax collection trends, make future projections and help make informed decisions for the review of different tax policies. AI enhances the systematic processing and transparency of tax data, which increases the intensity of government supervision and motivates the ongoing modernisation of tax administration function. Transparency in tax administration can help build trust in tax systems, thus boosting morale and resultantly increasing tax compliance. Consequently, it is crucial to assess carefully the challenges, opportunities and possible implications that can emerge from the application of AI in tax administration. It is worth noting that the impact of the opportunities and challenges as well as how these are exploited and mitigated will depend on the contextual, legal and regulatory environments of each country as well as their tax policy and other factors such as how technology is embraced, digital literacy and government support.

Recommendations

From the literature review, it was deduced that developing countries might need to improve in some areas to create a conducive environment for the development and deployment of AI in tax administration. Informed by the challenges discussed in prior sections, this section makes possible suggestions to mitigate the challenges and harvest the gains of using AI to enhance the

efficiency and effectiveness of revenue administration in developing countries. These recommendations include having a strong team with strong leadership to lead the adoption of AI in revenue authorities, dedicating financial resources towards the development and deployment of AI systems, minimising corruption in the launching of the AI project and building relevant technical expertise for the use of AI in tax administration.

a) Implementation of AI in phases

Given the challenges facing revenue authorities in developing countries regarding the adoption of AI in tax administration such as the shortage of financial resources, limited technical expertise, and poor digital infrastructure, a phased approach could be adopted. Revenue authorities could use a staggered approach to implementation by breaking the project into small manageable phases that accommodate their limited budgets. The tax administration authorities could start with minor pilot projects and intensify the adoption as and when funds become available. This not only helps plan for the investment in AI for tax administration but also ensures that the project is done gradually to enable time for change management for both revenue authorities and taxpayers.

b) Create a pool of data for taxpayers' database

Requirements needed due to the use of new technologies by the tax authorities highlighted earlier AI technologies such as big data, data analytics, and machine learning require large amounts of data and in this case taxpayers' data, it is critical to create a reliable and strong database. This entails collecting, categorising, and securely storing large volumes of data concerning businesses, taxpayers, and transactions. This data can then be used for the training and deployment of AI-driven systems.

c) Invest in AI education, skills development, and training

Governments, revenue authorities and educational institutions in developing countries need to invest in AI education and technology in education in general. This is pivotal for the creation of a digital and AI-skilled workforce, starting from university and college graduates. Some revenue authorities such as Zimbabwe have their training schools where they train the graduates that they would have recruited for employment specifically in tax administration. Courses on digital tools and technologies such as the 4IR technologies, the Fifth Industrial Technologies, Fintech, and Forensic audit technologies could be incorporated to equip these prospective tax officials with appropriate digital knowledge. Revenue authorities could also upskill the current workforce through training, seminars,

and continuous professional development programs. This could make employees more comfortable, knowledgeable, and effective in the use of technology and in this case specifically AI technologies. Lastly, revenue authorities could invest in technical expertise, that is by ensuring their pay market-related remuneration and benefits that can attract and retain employees with the right skills to develop and deploy AI-supported systems. This also requires support from the government and ministries of finance to fund the investment in AI education, skills development and training as well as attractive salaries. Governments should also invest in research and development in AI as well as in digital infrastructure and technologies that aid in the building of ecosystems that allow for knowledge sharing and data sharing among government departments.

d) Collaboration with the private sector

Revenue authorities in developing countries could collaborate with the private sector in the development and deployment of AI-supported systems. Tapping from the private sector skills and experience, through collaboration and outsourcing technical expertise, revenue authorities could successfully develop AI-driven solutions for tax administration.

e) Construct strong laws and regulations on data privacy and security

AI systems collect and analyze large volumes of personal data. This raises privacy and confidentiality concerns. With AI systems being relatively new in developing countries, countries need to construct appropriate and effective privacy laws and regulations to protect the privacy of taxpayers. Developing countries should formulate legal and regulatory policies that enable the implementation of secure and dependable AI systems that foster collaboration and cooperation with revenue authorities in other countries. Countries should also put measures in place to reduce harmful and unanticipated outcomes that can perpetuate inequalities and tax injustice intentionally or unintentionally. AI tax administration must not violate the rights of taxpayers and harm disadvantaged populations. Having the appropriate legal and regulatory frameworks toward data privacy and security will also boost public trust and confidence among taxpayers about the use of AI in tax administration.

f) Communication with employees, taxpayers, and other stakeholders

Change is generally associated with some resistance and mistrust from both employees and stakeholders and in this case taxpayers. AI adoption is relatively novel in many developing countries and there is some mistrust associated with the introduction of new technologies more so in tax administration. To

ensure smooth and acceptable change management, revenue authorities must have strong leadership for the AI deployment project. This leadership will not only spearhead the development of the AI system but mobilise financial and technical resources to support it, communicate, and share the AI-powered system vision and strategy of deployment. Successful change management requires acceptance and support by employees. Tax administration authorities must also develop a culture of innovation among their employees. This would enable them to accept and embrace change as well as to feel free to share new ideas and even give criticism and constructive feedback that could improve the AI system. Tax administrators are often considered very aggressive towards taxpayers, hence the relationship is volatile, AI development and deployment would be seen to be another way to exploit or overtax taxpayers. Therefore, tax administration authorities need to build trust by ensuring transparency and accountability in the use of AI. Trust could also be fostered by communicating with taxpayers about the use of AI in tax administration, addressing the what, how, and why questions. Revenue authorities need to be transparent in their communications by sharing the benefits and potential limitations as well as how taxpayers could mitigate the potential negative externalities.

g) Government commitment or political will

There is a need for government commitment and political will to support the development and deployment of AI technologies in tax administration. According to the OECD (2022a) government officials and institutions such as the Ministries of Finance need to be aware of the potential benefits of AI in tax administration and be convinced and willing to invest in these systems. The costs might be substantial in the short term but the envisaged benefits might compensate for the investment in the long term. The costs of IFFs, smuggling and tax evasion are significant in developing countries. Substantial potential revenues are lost, yet these could fund infrastructural development, poverty alleviation and the attainment of the SDGs in developing economies.

Limitations and areas of further research

This paper is a review paper and considering that the use of AI technologies in developing countries is still in its early stages, research in AI-supported tax administration is still minimal but growing, therefore the review only found a few papers relevant. To address this void, the journal articles found were also supported with grey literature. Conference papers, African Tax Administration Forum, OECD and UNDP working papers and policy briefs were also used. The

limitations of grey literature could have affected some of the arguments raised in the review. Future researchers are encouraged to do empirical research on the few developing countries that have deployed AI in their tax administration systems to assess the benefits, constraints and likely implications pointed out in this review.

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