Exploring the Potential and Challenges of Ai and Blockchain Integration for Revenue Enhancement in Pakistan: A Comprehensive Policy Analysis

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Abstract:

The efficiency of Pakistan's tax system is currently hindered by a low tax-to-GDP ratio and persistent fiscal deficits, exacerbating the country's reliance on external borrowing. Recent advancements in Artificial Intelligence (AI) and blockchain technology present an opportunity to enhance revenue generation and streamline tax administration. This paper explores the transformative potential of integrating these technologies into Pakistan's tax system, identifying both the benefits and the challenges associated with their adoption. Key challenges include the need for substantial infrastructure investment, concerns over data privacy, and the necessity for a supportive legal framework. The paper recommends several policy actions, including the establishment of a regulatory framework for AI and blockchain, legal amendments to support these technologies, and the development of robust IT infrastructure and digital identity systems. Addressing these recommendations will be crucial for modernizing Pakistan's tax administration and improving compliance, ultimately helping to break the cycle of debt and foster economic growth.

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Introduction

Taxation forms an indispensable pillar of a nation's financial framework, levied either directly or indirectly on individuals for the services rendered by the government or its agencies. Primarily aimed at funding public expenditure, the bulk of government revenue is derived from taxes. Moreover, the tax system serves as a crucial instrument in pursuing various objectives, such as equity and fostering social and economic progress within an economy. A meticulously designed tax system is thus one of the fundamental requirements for enhancing GDP growth (Shehzad & Maqbool, 2018).

To assess the performance of revenue collection in an economy, the tax-to-GDP ratio serves as a robust and inclusive measure. Pakistan's tax-to-GDP ratio stands at 9.75 percent, notably lower compared to other Asian economies. Nepal reports a ratio of 19.9%, Taiwan 15.1%, Singapore 15%, and Sri Lanka 12.3% (Shehzad & Maqbool, 2018).

The poor performance of tax revenue generation in Pakistan leads to persistent fiscal deficits, which force the government to explore other options like borrowing from banks or international donors to meet its budgetary demands. This, in turn, leads to a high debt servicing burden on the Federal Government (World Bank, 2023).

Hence, Pakistan finds itself trapped in a perpetual cycle of debt. However, with the introduction of new technological tools such as Artificial Intelligence (AI) and Blockchain, there is an opportunity for developing countries like Pakistan to enhance revenue generation from taxes by utilizing these tools.

Pakistan is no different when it comes to utilizing these tools for revenue generation, and hence it needs to adopt international best practices in this area to enhance its revenue generation potential.

However, the implementation of such technologies presents challenges. Integrating AI and blockchain into existing tax systems demands substantial investment in infrastructure and training. Furthermore, concerns surrounding data privacy and the security of taxpayer information in the digital sphere are paramount. Tax authorities in Pakistan must navigate these challenges cautiously to ensure successful technology adoption. Despite existing challenges, the potential benefits of these technologies in streamlining tax processes, improving compliance, and safeguarding data integrity are substantial. Embracing these digital tools will be crucial as tax administrations continue to evolve, shaping the future of tax compliance and administration (Adelekan & Adisa, 2024).

Statement of the Problem

Despite repeated efforts by the government, Pakistan has not been able to

increase its tax-to-GDP ratio. However, with advancements in AI and blockchain technology, along with Pakistan's recent draft National Artificial Intelligence Policy, the country has been presented with an opportunity to enhance its revenue generation. This situation calls for a study to undertake thorough research on how AI and blockchain can be integrated into Pakistan's tax system to achieve the full tax potential of Pakistan's economy.

Research Questions

Q1. What are the main challenges in adopting AI and blockchain for tax revenue enhancement in Pakistan?
Q2. What policy and investment measures are needed to integrate AI and blockchain into Pakistan's tax system?

Scope of study

The study will review the literature on the use of AI and blockchain for revenue generation by tax authorities and analyze the current situation of tax automation in Pakistan. It will also examine the Draft National Artificial Intelligence Policy and identify gaps in Pakistan's prevailing legal, institutional, and policy framework concerning the integration of AI and blockchain with tax administration.

Literature review

The integration of AI and blockchain technology into tax administration is motivated by the necessity for enhanced efficiency, security, and transparency in tax systems. This integration addresses numerous challenges faced by both tax administrations and taxpayers, presenting innovative solutions for managing compliance. Previous research has comprehensively dealt with this issue.

AI's transformative role in tax administration is evident in its ability to analyze large volumes of tax data. This capability enables more effective risk assessment and fraud detection, improving the accuracy of tax assessments and aiding in proactive tax evasion prevention. Conversely, blockchain's immutable characteristic offers a sturdy foundation for documenting transactions, consequently diminishing the likelihood of fraud and strengthening the integrity of tax systems. These digital tools have prompted a shift in the organizational structure and business processes within tax administrations (Adelekan & Adisa, 2024).

In developing economies like Pakistan, the conventional tax system has encountered numerous hurdles, including inadequate tax collection, a lack of precise tax data, deficient record-keeping, intricate payment procedures, and elevated expenses associated with tax compliance. These challenges frequently lead to substantial tax revenue losses and inefficiencies in tax

administration (Amarachi & Nwambe, 2019).

Blockchain technology, when utilized in tax law and administration, presents an innovative approach to managing tax-related data and transactions. Lyutova and Fialkovskaya (2021) delve into the application of blockchain in tax matters, particularly within the realm of digital financial assets and tax oversight. Their study emphasizes the effectiveness of blockchain in tax and legal frameworks, highlighting its potential to improve tax processes.

Rainero and Modarelli (2021) offer a conceptual examination of blockchain's involvement in public administrative procedures, with a particular emphasis on its potential within the public sector. Their study underscores the diverse applications of blockchain in public management, presenting a framework that integrates its primary functions and future prospects. This conceptual framework demonstrates the potential for blockchain to revolutionize administrative processes, highlighting an approach centered around citizens that promotes transparency and accountability.

Blockchain technology introduces new administrative prospects in taxation. Its integration can result in more organized data, cost savings, secure frameworks (including fraud detection), and a decentralized transactions database. Leveraging smart contracts within blockchain frameworks can automate payments, transfers, and asset accounting, ultimately reducing transaction costs and fostering more efficient taxation operations (Grundel & Zhuravleva, 2021).

The decentralized and immutable characteristics of blockchain technology render it an ideal tool for securing tax data, ensuring the integrity and reliability of tax records (Kim, 2022). Blockchain has the potential to substantially enhance the distribution and security of tax data, streamlining the submission and processing of tax invoices while making them more traceable (Ashfaq & Iftikhar, 2022).

The amalgamation of AI and blockchain technologies in tax administration signifies a notable transition towards increasingly data-driven and automated systems. AI's proficiency in data analysis and pattern recognition synergizes with blockchain's secure and immutable record-keeping, resulting in a combined effect that boosts the precision and dependability of tax processes (Adelekan & Adisa, 2024).

Research Methodology

The study employs a qualitative approach, focusing on the interpretation and synthesis of existing literature to derive conclusions regarding the current status and potential use of AI and blockchain in tax administration in Pakistan to enhance its revenue. This method enables a comprehensive understanding of intricate issues and facilitates the formulation of informed recommendations.

Organization of the Paper

The paper is divided into three sections. Section I presents a general analysis of AI and blockchain and their impact on enhancing tax revenue. Section II provides a situational analysis of the legal and institutional framework for revenue generation in Pakistan, along with a gap analysis of the FBR's IRIS software system. Section III offers a critical analysis of Pakistan's Draft National Artificial Intelligence Policy, a risk analysis of adopting AI and blockchain for revenue generation in Pakistan, and a gap analysis of Pakistan's legal and organizational framework concerning the adoption of AI and blockchain in revenue generation.

Analysis of AI and Blockchain for Enhancement of Revenue

What is AI and Blockchain

"Artificial Intelligence (AI) refers to the simulation of human intelligence in machines, specifically computer systems, that are programmed to perform tasks that typically require human intelligence, such as learning, problem-solving, and decision-making. These systems are designed to analyze vast amounts of data, recognize patterns, and adapt to new information, enabling them to perform tasks autonomously without explicit programming" (Russell & Norvig, 2021).

"Blockchain is a distributed ledger technology that enables secure and transparent peer-to-peer transactions without the need for intermediaries. It consists of a chain of blocks, each containing a record of transactions that is cryptographically linked to the previous block, forming an immutable and tamper-resistant database. Blockchain technology ensures data integrity, decentralization, and consensus among participants in the network" (Narayanan, 2016).

Analysis of Impact of AI and Blockchain on Revenue Enhancement and Tax Compliance
Improving Tax Compliance Through Adoption of Blockchain

The fundamental reason behind embracing blockchain technology in tax compliance stems from its capacity to decentralize and authenticate tax procedures. The concept of 'tax compliance by design,' wherein blockchain technology is employed to ensure compliance in business operations, particularly concerning value-added taxes, has been explored in earlier research. This method capitalizes on blockchain's inherent attributes, such as transparency and immutability, to establish a more dependable and effective tax compliance environment. By incorporating compliance into the framework of business processes, blockchain technology has the potential to notably simplify the complexity and reduce the costs associated with tax compliance (Fatz, 2019).

Empirical studies provide additional evidence of the influence of blockchain on taxpayer compliance. One study from 2022 illustrates how blockchain technology can efficiently tackle non-cooperative behavior and narrow the tax gap. Through research employing panel data models and agent-based simulations, it has been shown that integrating blockchain enhances the operational effectiveness of tax administrations such as the Internal Revenue Service (IRS) and reinforces enforcement mechanisms. This leads to heightened compliance rates and fewer occurrences of tax evasion (Alexander, 2022).

Enhancing Revenue Collection Through Blockchain

Blockchain technology can enhance revenue levels and improve compliance tracking through its security, immutability, and real-time information capabilities. This may result in decreased tax evasion and fraud, with taxpayers experiencing reduced compliance expenses and improved experiences through more streamlined processes (Nascimento, Da Silva, & Peres, 2021).

Improving the Effectiveness, Efficiency, and Security of Tax Systems Through Adoption of Blockchain

Blockchain technology holds promise for enhancing the tax administration system. Governments can use it for (i) digitizing key elements of tax administration, (ii) securely capturing and disseminating a substantial volume of authenticated, reliable, and high-quality tax-related data among authorized stakeholders, (iii) granting taxpayers and tax authorities immediate access to tax records and documentation, and (iv) automating specific tax procedures and computations (Sulami, 2022).

Using AI and Blockchain for Predictive Analytics

The fusion of AI and blockchain technologies presents the opportunity for predictive analytics in tax administration. This capability empowers tax authorities to forecast future trends and patterns in tax compliance, facilitating proactive and strategic planning. Nonetheless, harnessing these advantages necessitates tackling challenges associated with implementing and integrating these technologies into current tax systems. Concerns such as infrastructure development, skill augmentation, and policy formulation need to be meticulously addressed to ensure the effective adoption of AI and blockchain in tax administration (Adelekan & Adisa, 2024).

Institutional and Legal Framework for Revenue Generation in Pakistan and Gap Analysis of FBR's Automation Software
Institutional and Legal Framework for Revenue Generation in Pakistan

In Pakistan, taxes are collected both at the federal and provincial levels. The details of taxes collected at various levels and the bodies responsible for the

collection of those taxes are given below.

a) Taxes at the Federal Level

At the federal level in Pakistan, the major taxes are:

Income Tax

Income tax is a direct tax imposed on the 'taxable income' of individuals, businesses, and other entities by the government of Pakistan. It is a key source of revenue for the government and is used to fund various public services and projects. The collecting agency for income tax is the Inland Revenue Service (IRS), which is a wing of the Federal Board of Revenue (FBR). Income tax is regulated through the Income Tax Ordinance, 2001.

Sales Tax on Goods

Sales tax is payable on the supply of goods at the rate of 18%. For certain retail items, it is collected from the manufacturers of the goods (e.g., on beverages). In Islamabad, sales tax on services is also collected at the federal level by the Federal Board of Revenue (FBR). Import of goods by commercial importers is also subject to sales tax at 3%, in addition to the original sales tax payable at 18%. The collecting agency for sales tax on goods is the Inland Revenue Service (IRS), which is a wing of the FBR. Sales tax on goods is regulated through the Sales Tax Act, 1990.

Federal Excise Duty (FED)

FED is imposed on specific categories of excisable goods and services at different rates. Regarding FED on services, it is limited to the Islamabad Capital Territory. However, on goods, it is collected throughout Pakistan. The collecting agency is the Inland Revenue Service, which is a wing of the Federal Board of Revenue (FBR). FED is regulated through the Federal Excise Act, 2005.

Customs and Imports Duty

At the import stage, customs duties and certain other fees are collected at different rates, categorized according to the Harmonized System (HS) Code. The collecting agency is Pakistan Customs, which is a wing of the FBR. Customs duty is regulated through the Customs Act, 1969.

The share of FBR (Federal) and Provincial Tax Authorities (Provincial) in the total collection of revenue is given in Table 1 below.

	FY2023 B. E	July-March		Growth
		FY2023	FY2022	
A. Total Revenue	10,370.0	6,938.2	5,874.2	18.1
% of GDP	13.3	8.2	8.8	-
a) Tax Revenue	8,260.0	5,617.7	4,821.9	16.5
% of GDP	10.6	6.6	7.2	-
Federal (FBR Taxes)	7,470.0	5,155.9	4,383.6	17.6
% of GDP	9.6	6.1	6.6	-
Provincial Tax Revenue	790.0	461.8	438.3	5.4
b) Non-Tax Revenue	2,110.0	1,320.5	1,052.2	25.5
% of GDP	2.7	1.6	1.6	-

Source: Economic Survey of Pakistan 2022-23

As evident from the above table, the FBR is responsible for the collection of almost 90% of the revenue from taxes in Pakistan.

b) Taxes at the Provincial Level

Sales Tax on Services

This tax is levied by the provinces. After the promulgation of the 18th Amendment, the collection of sales tax on services was devolved to the provinces, and now each province has its own revenue collection authority to collect this tax. Every province has promulgated its own Sales Tax Rules and Regulations to regulate the imposition and collection of these taxes.

Excise, Professional, and Property Taxes

These taxes are collected by the provinces through municipal governments, excise and taxation departments, and other bodies.

Present Scenario of Database Management, Automation, and IT Systems at FBR

The introduction of electronic tax systems, commonly known as e-tax, marks a transformative step in addressing challenges to taxation. E-tax systems present a more streamlined and user-friendly approach to tax administration, simplifying compliance for taxpayers and enabling more efficient collection for tax authorities. Research has demonstrated that the adoption of e-tax systems substantially enhances tax revenue collection, improves the accessibility and precision of tax records, and diminishes the overall expenses associated with tax compliance (Amarachi & Nwambe, 2019).

Pakistan has also launched a similar digital platform called the Inland Revenue Information System (IRIS) to allow taxpayers to file their tax returns as well as fulfill any other legal requirements under the Federal Tax Laws of Pakistan. The system was launched in 2014 as a comprehensive database management system to automate the filing of federal taxes in Pakistan.

Inland Revenue Information System (IRIS)

Figure: I IRIS Dashboard
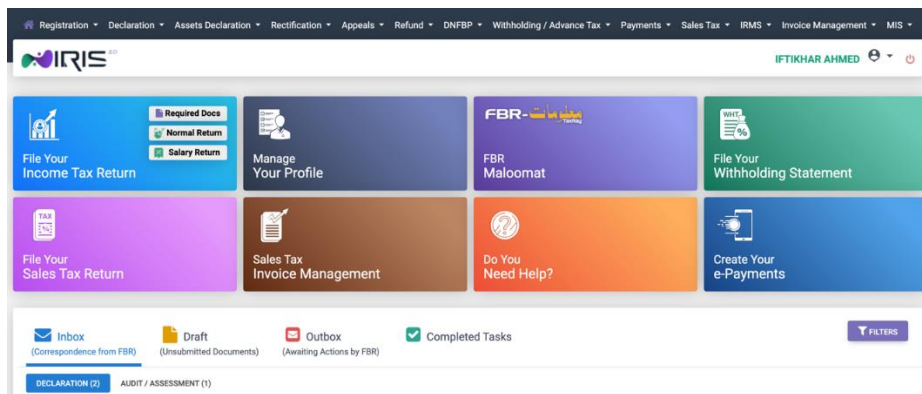
Source: FBR

IRIS was introduced in 2014 to replace the legacy Income Tax Management System (ITMS), which was the first computerized database management system of the FBR with only partial automation. ITMS only allowed the filing of returns and maintenance of the taxpayers' returns database. However, IRIS provides a comprehensive database solution which includes:

- Online filing of tax returns, applications for refunds, replying to notices, and covering all the taxpayer-side provisions given in the Income Tax Ordinance, 2001, and Sales Tax Act, 1990.
- Issuance of electronic notices to taxpayers for both Income and Sales Tax.
- Seeking online replies from taxpayers in response to notices issued by the tax authority.
- Issuance of bar-coded tax exemption certificates.
- Maintenance of complete taxpayer records, i.e., registration information, returns filed, tax payments, pending audits, all previous notices and orders issued in a case, outstanding tax demands, tax deducted by employers and other agencies like banks, property transfer authorities, excise and taxation departments, etc.

IRIS is therefore a complete centralized database solution employed by the FBR to maintain its taxpayer records. Although the FBR has been largely successful in digitizing its records and moving from a traditional paper-based system to an online computer-based system, the notices issued by officers, scrutiny of taxpayer online replies, and record-keeping, along with audits of taxpayers, still require significant human intervention. The system needs to be operated by officers who have to keep track of all the cases in their respective jurisdictions by regularly checking their accounts for updates from taxpayers.

However, AI, with its computational ability, can be leveraged to revolutionize tax processes and enhance tax effectiveness and transparency by implementing data-driven tax administration, streamlining repetitive tax duties, bolstering efforts against tax evasion, and enhancing taxpayer services through automation and AI technologies (Serrano Anton, 2022).

Gap Analysis of IRIS vis-à-vis Integration with AI

In this section, a gap analysis is performed by comparing the current state of IRIS with a desired state in which AI is integrated into the system to implement a data-driven tax administration and where repetitive tasks are completely automated through AI without human intervention.

Sr No	Current State	Action Plan	Desired State
1	Taxpayer assistance is provided through phone helpline	Integration of AI powered chatbot in IRIS	Provision of immediate assistance to taxpayers for clarifications and guidance on tax filing and resolution of complaints
2	Data in tax returns is manually entered by the users	Use of AI to recognize taxpayer data from different sources using CNIC number and generate a draft amendable return for the taxpayer	Tax returns are generated automatically by utilizing already available user data from other sources such as employers, banks and property transactions etc.
3	Notices to taxpayers are issued on a case to case basis through human intervention	Training AI module to calculate the due date of filing of returns and issue notices in bulk to all the non-filers along with follow-up notices and imposition of fines as per the tax laws	Automatic generation of notices to taxpayers once the due date of return filing is lapsed
4	Tax payer audit is manually conducted by going through voluminous record and checking compliance with tax laws	Development of an AI Module in IRIS which can be trained to analyze taxpayer record and calculate the tax default based on violations of tax laws	Automatic generation of show cause notices to taxpayers based on violation of tax laws
5	No provision of personalized messages to taxpayers for enhancing	Utilization of behavioral economics principles using AI to compute	Personalized and tailored nudging and reminders to inform taxpayers about their national duty as well

compliance and promotion of tax filing culture	tax liabilities and amount of fine and penalties for dissemination to the taxpayers	as consequences of non-filing such as fine and default surcharge

Critical Analysis of Draft National Artificial Intelligence Policy

In May 2023, the Ministry of Information Technology & Telecommunication (MoITT) of Pakistan released a consultative draft of the nation's inaugural National Artificial Intelligence Policy. Additionally, the Ministry announced plans to establish a Policy Committee tasked with gathering input from various stakeholders, including academia, industry, and government officials. Following this consultation process, the draft is expected to undergo finalization.

The draft policy, however, exhibits five key overarching flaws:

Lack of a Comprehensive National Approach to AI:

The draft should have been formulated through inclusive, multi-stakeholder consultations involving industry and academia, facilitating the development of a unified strategy for AI. This inclusive approach should have preceded the drafting process, which instead relied on exclusive coordination with selected consultants.

Administrative Resistance/Capacity Issues to Digitalization:

Addressing this ingrained issue necessitates stringent political oversight from both federal and provincial governments working collaboratively. Additionally, preparations should commence for the gradual phasing out of traditional administrative roles if the state genuinely aims to embrace AI effectively. Currently, the adoption of AI tools, especially in governance and the public sector, is extremely difficult due to a lack of training for officers and officials as well as a significant knowledge gap.

Internet Accessibility and Connectivity:

AI and blockchain technologies are dependent on the internet. However, in Pakistan, outages and censorship from the state due to security and other reasons are regularly encountered. The policy is silent on this critical issue of internet access and censorship in Pakistan and does not provide a mechanism for safeguarding AI and blockchain-backed processes in official circles.

Futility of Setting Arbitrary Goals:

Integrating AI into routine departmental tasks should be avoided due to the dynamic and evolving nature of AI intricacies and protocols. While it is acceptable to articulate ambitions and aspirations, imposing rigid deadlines

or cut-off dates is impractical in a country like Pakistan, where awareness of AI remains limited. Such unrealistic deadlines may inadvertently encourage shortcuts to achieve objectives, leading to quality control issues and other shortcomings.

Fragmented Approach to AI Research and Development:

Achieving an integrated and holistic approach to AI necessitates synergy, which can be achieved through the appointment of a National Coordinator (or similar authority) operating autonomously. This office should operate with minimal resources, solely focused on coordinating efforts among existing channels, rather than establishing new bureaucratic layers that could further complicate the process.

Risk Analysis of Introducing AI and Blockchain in Revenue Generation

The incorporation of advanced technologies like Artificial Intelligence (AI) and blockchain into tax systems introduces a multitude of challenges spanning technical, infrastructural, legal, and operational domains. Pakistan is no different. Addressing these challenges is crucial to ensure the effective integration and optimal performance of these technologies in tax administration.

Technical and Infrastructure Risks:

One of the primary hurdles lies in technical and infrastructural limitations. Integrating AI into tax systems, especially in areas like tax collection and administration, necessitates a robust technological infrastructure comprising advanced computing resources, data storage capabilities, and a skilled technical workforce. Such requirements may pose significant obstacles, particularly for tax administrations in developing countries where resources are limited (Li, 2022).

Data Privacy and Security:

In addition to technical concerns, data privacy and security are key issues. The deployment of AI and blockchain technologies raises fundamental questions regarding the protection and confidentiality of sensitive taxpayer information. Upholding data privacy and adhering to stringent data protection regulations are essential aspects of implementing these technologies in tax systems. This underscores the need for rigorous security protocols and compliance with legal standards to safeguard taxpayer data (Adelekan & Adisa, 2024).

Legal and Regulatory Framework:

The evolving legal and regulatory frameworks surrounding AI and blockchain use in tax systems add another layer of complexity (Bobek, Ghosh,

& Horvat, 2021). In the context of Pakistan, there is currently no regulatory framework for the use of AI and blockchain in revenue generation. There is a need for clear, comprehensive legal frameworks governing the application of these technologies. This includes regulations on data usage, AI decision-making processes, and the legal status of blockchain transactions. Developing and continuously updating these frameworks are crucial for ensuring the lawful and ethical use of AI and blockchain in tax systems.

Integration of New Technology with Legacy Systems:

Integrating AI and blockchain technologies with existing tax systems poses another critical challenge. Ensuring compatibility and seamless integration with legacy systems such as IRIS is vital to prevent disruptions in tax administration processes. This necessitates meticulous planning, testing, and phased implementation strategies to ensure smooth integration.

Skills Gap

Addressing skill gaps and training needs is essential for the effective utilization of AI and blockchain by tax authorities. Developing expertise in these technologies is crucial for their successful implementation and management. This involves not only training tax officials and IT personnel but also ensuring ongoing learning and adaptation as these technologies evolve (Fernando & Sepliana, 2019).

High Cost of Implementation

The cost implications of implementing AI and blockchain technologies cannot be underestimated. The financial aspects, including investments in hardware, software, and human resources, can be significant, particularly for tax administrations operating in resource-constrained environments. Balancing costs with potential long-term benefits is a critical consideration in the decision-making process (Adelekan & Adisa, 2024).

Digitization of Economy

To utilize AI tools and implement blockchain for the management of databases, it is imperative that there be availability of digital records that can be interpreted by AI tools or stored in the form of blockchain. However, in Pakistan, most transactions still take place in cash and are not digitized. The cash in circulation in Pakistan by the end of June 2023 was 30% of the total money supply in Pakistan (Raza, Sultan, & Zafar, 2023). This poses a serious threat to the viability of AI and blockchain tools in tax administration in Pakistan.

Removal of Bias

AI also poses a potential risk of introducing bias in tax analyses, which needs

to be regulated by studying international best practices and adopting global standards of algorithm development for tax analysis by AI tools (Gavoor & Raffi, 2021).

Gap Analysis of Legal and Organizational Framework of Pakistan in Utilizing AI and Blockchain

Considering Pakistan's legal and organizational framework in relation to tax collection and the use of AI and blockchain, the following gaps have been identified that need to be addressed to enable tax authorities to adopt these technologies for improving revenue generation.

Sr No	Current State	Action Plan	Desired State
1	No Legal Framework to regulate the validity of the use of this technology within the taxation authority	Drafting of Laws for regulation of use of AI and Blockchain in public sector as well as revenue authorities and bodies	A comprehensive regulatory framework that allows the use of blockchain and AI in tax regulation in Pakistan
2	Un-availability of infrastructure including hardware, software and IT capabilities with the FBR	Provision of relevant IT infrastructure to FBR	Availability of IT infrastructure to utilize AI and Blockchain technology for tax compliance and revenue generation
3	Lack of trained staff to utilize AI and Blockchain Technology by FBR	Training of staff as well as hiring of fresh IT graduates to meet the knowledge gap	Well trained staff with good understanding of using AI and Blockchain technology
4	Lack of a digital identity to make transactions that are on the blockchain network	Development of digital identities for staff of tax authorities so that they can access the blockchain networks and become a valid node in the network	Presence of digital identities for staff of tax authorities who can make transaction on blockchain
5	No policy that can minimize the risks inherent in blockchain and AI technology	Development of a regulatory framework in consultation with all the stakeholders	Presence of a policy that regulates the use of AI and blockchain in public services and that minimizes the risks by mandating ethical use of these technologies in public domain
6	Pakistan is still predominantly a	Digitization of government and land	Digitized economy that can fully exploit the

	cash economy with little digitization	record. Discouraging the use of cash in financial transactions	potential of AI and Blockchain by moving from web 2.0 to web 3.0

Conclusion

While the integration of AI and blockchain technologies in tax systems offers transformative potential, it is accompanied by a range of challenges that must be carefully managed. The current legal and institutional framework, as well as human resource and IT infrastructure in Pakistan, requires significant improvement and investment to address the challenges associated with the adoption of these technologies. Tackling these challenges necessitates a holistic approach that includes technical and infrastructural development, legal and regulatory adjustments, stakeholder engagement, skill development, and financial planning. Successfully navigating these challenges is crucial to harnessing the full potential of AI and blockchain in modernizing the tax administration system in Pakistan.

Recommendations/ Way forward

Based on the analysis presented in the above sections, the following actions and policy recommendations are proposed to fully tap the potential of AI and blockchain in revenue enhancement in Pakistan:

Recommended Changes in the Legal Framework

- Formation of a regulatory legal framework that addresses data privacy issues and mandates the responsible use of AI and blockchain technology by tax authorities.
- Legal amendments to tax laws in Pakistan to permit AI-based audit selection and the performance of tax audits.
- Changes in tax laws to recognize blockchain as a legally acceptable source for record-keeping and accounting for businesses.
- Implementation of laws to discourage the use of cash in the economy and promote digital transactions to support the digitization of the economy. This will facilitate the use of AI in detecting tax fraud and evasion.
- The Federal Board of Revenue and Provincial Sales Tax Authorities should work towards developing and adopting a digital invoice system. The current Point of Sales system enforced on businesses should be replaced with blockchain-enabled invoice systems that cannot be altered.
- To fully harness the potential of blockchain, the government needs to adopt a single digital identity system for users. Currently, individuals can have multiple digital identities; however, there is a need for legislation to

develop a unified digital identity system usable across all blockchain systems within and outside the country.

Recommendations for Development of Infrastructure and Human Resources to Enable the Use of AI and Blockchain

- Upgrade the existing IT infrastructure of tax authorities to enable blockchain-based decentralized database management.
- Develop IT software tools that incorporate AI for automating routine repetitive tasks of tax authorities.
- Hire new IT professionals and train existing staff working in tax authorities on the use of AI tools and blockchain technology.
- Integrate AI into existing database systems like IRIS to perform taxpayer audits, risk assessments, predictive analysis, tax collection projections, identify tax shortfalls, areas for improvement, and new taxpayers for broadening the tax base.
- The State Bank of Pakistan should work towards developing a state-owned tokenized currency that operates on the same blockchain as that deployed by the tax authorities. This will make transactions traceable and assist tax authorities in tracking the flow of funds in the economy.

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