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Criteria for Assessing the Effectiveness of Digital Tax Administration

Samaya Salahova[1]

Abstract. *Digital technologies are rapidly entering all public administration areas, transforming how information is collected and processed, allowing faster and more effective decisions. Digitalization of tax administration is not only about technical aspects but also about the managerial and strategic dimensions of the effectiveness of digital technologies. This research employs a multi-criteria decision-making (MCDA) model alongside key performance indicators (KPIs) to evaluate the effectiveness of digital tax administration systems. The study aims to analyze digitalization's effects on tax administration, explore technological integrations' fiscal and administrative ramifications, and develop a methodological framework informed by international experiences. The study's theoretical background reviews previous research and the practices of leading nations (including OECD countries, Estonia, Russia, Turkey, and Mexico). The research methodology employs a mixed-methods approach, utilizing quantitative and qualitative data. Statistical metrics were gathered to compare conditions pre- and post-digitalization. The author conducted surveys with taxpayers and tax authorities and expert interviews to evaluate the system's institutional aspects. The collected data was analyzed using SPSS, NVivo, and Excel, incorporating thematic analysis, trend analysis, and correlation methods. This study organized the evaluation criteria into three categories: a) Economic Criteria: Reduction of operational costs, increase in revenues, narrowing of the tax gap, and return on investment (ROI); b) Administrative Criteria: Flexibility in decision-making, extensive audit capabilities, transparency, and accountability; c) Technological Criteria: System stability, level of automation, data security, and user interactivity. The outcomes, weighted according to these criteria, were aggregated using the MCDA model to derive the overall efficiency index. Findings indicate that introducing digital systems results in a 20–25% reduction in administrative costs enhances audit resources' effectiveness, and leads to a consistent rise in tax revenues. Concurrently, taxpayer satisfaction levels and the rate of voluntary compliance have improved. Azerbaijan's learned experience in improving tax administration through digital technologies can be a model for other countries in the region. Technological elements such as e-invoices, e-cash registers, API integrations, personal accounts, and ASAN signatures have established a framework for centralizing data within the tax system and automating decision-making processes. In Azerbaijan, the tax gap has decreased from 20% to 11.5%, with 95% of declarations being filed electronically. As a result, Azerbaijan achieved an efficiency index of 87.95 points. The study provides recommendations for digitalizing tax administration, focusing on efficiency criteria. After all, digital tax administration is not just technology but also a tool for good governance, open policies and better public control. If properly implemented, these systems increase tax collection and citizens' trust in the state.*

Keywords: *digital tax administration, tax technologies and innovations, efficiency criteria, multi-criteria decision-making, KPI.*

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[1] **Samaya Salahova**, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan.
ORCID 0009-0004-8470-6752
E-mail: samaya.salahova348@gmail.com

Критерії оцінки ефективності цифрового податкового адміністрування

Самая Салахова[1]

[1] *Азербайджанський державний економічний університет, м. Баку, Азербайджан*

Анотація. *Цифрові технології швидко проникають в усі сфери державного управління, трансформуючи способи збору та обробки інформації, дозволяючи приймати швидші та ефективніші рішення. Цифровізація податкового адміністрування стосується не лише технічних аспектів, але й управлінських та стратегічних вимірів ефективності цифрових технологій. Це дослідження використовує багатокритеріальну модель прийняття рішень (MCDA) разом з ключовими показниками ефективності (KPI) для оцінки ефективності систем цифрового податкового адміністрування. Мета дослідження – проаналізувати вплив цифровізації на податкове адміністрування, дослідити фіскальні та адміністративні наслідки технологічної інтеграції. Теоретичний базис дослідження охоплює огляд попередніх досліджень та практики провідних країн (включаючи країни ОЕСР, Естонію, Росію, Туреччину та Мексику). В дослідженні застосовано змішаний методологічний підхід, що передбачає використання кількісних та якісних даних. Для порівняння умов до та після цифровізації були зібрані статистичні показники. Автор провів опитування платників податків та податкових органів, а також інтерв'ю з експертами для оцінки інституційних аспектів системи. Зібрані дані були проаналізовані за допомогою SPSS, NVivo та Excel, включаючи тематичний аналіз, аналіз тенденцій та методи кореляції. У цьому дослідженні критерії оцінки були розподілені на три категорії: a) економічні критерії: скорочення операційних витрат, збільшення доходів, зменшення податкового розриву та рентабельність інвестицій (ROI); b) адміністративні критерії: гнучкість у прийнятті рішень, широкі аудиторські можливості, прозорість та підзвітність; c) технологічні критерії: стабільність системи, рівень автоматизації, безпека даних та інтерактивність користувачів. Результати, зважені відповідно до цих критеріїв, були агреговані за допомогою моделі MCDA для отримання загального індексу ефективності. Результати дослідження показують, що впровадження цифрових систем призводить до скорочення адміністративних витрат на 20–25%, підвищує ефективність аудиторських ресурсів та призводить до послідовного зростання податкових надходжень. Одночасно покращився рівень задоволеності платників податків та рівень добровільного дотримання податкового законодавства. Досвід Азербайджану щодо покращення податкового адміністрування за допомогою цифрових технологій може бути моделлю для інших країн регіону. Технологічні елементи, такі як електронні рахунки-фактури, електронні касові апарати, інтеграція API, особисті рахунки та підписи ASAN, створили основу для централізації даних у податковій системі та автоматизації процесів прийняття рішень. В Азербайджані податковий розрив зменшився з 20% до 11,5%, а 95% декларацій подаються в електронному вигляді. В результаті Азербайджан досяг індексу ефективності 87,95 балів. Дослідження містить рекомендації щодо цифровізації податкового адміністрування, зосереджуючись на критеріях ефективності. Зрештою, цифрове податкове адміністрування – це не просто технологія, а й інструмент належного управління, відкритої політики та кращого громадського контролю. За умови правильного впровадження ці системи підвищують збір податків та довіру громадян до держави.*

Ключові слова: *цифрове податкове адміністрування, податкові технології та інновації, критерії ефективності, багатокритеріальне прийняття рішень, KPI.*

INTRODUCTION

Nowadays, digitalization profoundly influences all sectors of society, including public management and financial control. The digitization of tax administration is one of the key aspects of this transformation. The tax authorities have been able to speed up info flow, increase tax accounting, broaden the tax base, and counteract tax evasion due to the digital superhighways.

The COVID-19 pandemic accelerated the transition to digital tax tools, as the effectiveness of "classic" physical-style administrative methods under quarantine conditions turned out to be low. Many countries that have adopted digital tax administration, namely the OECD member countries, have used a systems approach, and the output measures the system's effectiveness.

Over the past few years, structural and digital changes have taken place in the Republic of Azerbaijan, including electronic tax receipts, online cash receipts, a taxpayer's personal account, and database integration. These and other technological innovations have become significant achievements and are the subject of this study.

The evaluation of the results achieved through the application of technology is normally restricted to technical or economic parameters. But guidance decisions need to be based on multidisciplinary and systemic approaches. This is relevant not only for the evaluation of the efficacy of digital solutions already in place, but also to plan for future developments.

Therefore, this research aims to develop the criteria for the systematic evaluation of the effectiveness of digital tax administration and the examination of its application

mechanisms. Best practices will be reviewed, and good recommendations based on a comparative analysis of relevant digital solutions applied in Azerbaijan and selected foreign countries will also be delivered.

LITERATURE REVIEW

Digital tax management has been one of the primary instruments for modernizing the state's fiscal structures in recent years. Thanks to efforts by the OECD, the World Bank, and other international bodies, new methodological methods and criteria for digital tax management have been developed.

Junquera-Varela et al. (2022) highlight three drivers of the success of digital transformation: legal/supervisory environment, technological infrastructure and human capital. They analyze efficiency indicators in the process of digitalization of tax and customs administrations. Based on a comparison of EU countries' experiences, Dhaliwal et al. (2023) study the OECD guidelines on digital tax administration and the influenceof technological innovation on tax neutrality. Mpofu (2022) dissects the prospects and challenges digital taxation poses for African states, focusing on standardization and technological shifts as possible gains in efficiency. Bassey et al.'s (2022) study introduces a model for digital tax administration and defines a set of KPIs and criteria based on the model. Martínez et al. (2022) suggest a structural model that interrelates the efficiency of tax collection in OECD countries with the processes of digitalization, simplification, and education. Reyes-Tagle et al. (2023) propose a politically relevant framework for Latin America and the Caribbean, focusing on the evolution and impact of e-services. Ndlovu (2004) contrasts the experiences of countries like the United Kingdom and Kenya that have digital tax regimes and emphasizes success and challenges. Scarcella (2019) examines the legal and privacy challenges of digital tax systems and automated decision-making. Bunn et al. (2020) provide a map of digital tax applications worldwide and compare the efficiency of distinct regulations.

RESEARCH THEORETICAL FRAMEWORK

Digital Tax Administration Model

Digital tax management is a centralized and integrated governance mechanism created by using Information and Communication Technology (ICT). Its principal role has been to create digital communication channels between taxpayers and public institutions, through which tax-related processes can be monitored in real-time and, in that way, automated (Junquera-Varela et al., 2022; Reyes-Tagle et al., 2023).

Digital tax administration combines data gathering, data analytics, risk management, and taxpayer services into a single structure. Compared to the old manual and semi-digital tax administration, this reform aims to yield better compliance and minimize administrative complexities while ensuring the fiscal environment is clearer and more responsive (Bassey et al., 2022).

In digital tax implementations, components like blockchain, machine learning, and cloud are used for secure invoicing, risk profiling and scalable product-service deployment (Dhaliwal et al., 2023). These technologies do not operate in isolation and are interoperable and interconnected through centralized data infrastructures and common APIs, allowing data to be efficiently and with integrity across tax and fiscal institutions (Mpofu, 2022).

Moreover, digital tax administration introduces real-time taxpayer profiling, automated audit triggers, and personalized digital services such as e-invoices, mobile tax apps, and online taxpayer portals. These changes not only improve tax authorities' responsiveness but also increase the perceived fairness and accessibility of the tax system (Martínez et al., 2022).

Core Structural Components of Digital Tax Administration

The digital tax administration system comprises several integrated components that function collaboratively to streamline tax operations, enhance data accuracy, and promote taxpayer compliance. These components are outlined below:

a) Information Collection and Processing Systems

Modern digital tax infrastructures rely heavily on automated data capture from taxpayers and third-party systems. Key technologies include:

– Electronic Invoicing (E-invoices) enables secure, real-time transaction tracking and reduces the risk of underreporting or fraud (Bunn et al., 2020).

– Electronic Fiscal Devices (e-Kassas) are widely used to record point-of-sale (POS) transactions and automatically submit them to tax databases.

– Application Programming Interfaces (APIs) facilitate seamless integration between private-sector platforms (e.g., payment providers) and government tax systems, allowing for automatic data transfer and reconciliation (Junquera-Varela et al., 2022).

– E-commerce Tracking and Analytics allow tax authorities to monitor online sales data for VAT compliance and detect informal sector activities through digital footprints (Mpofu, 2022).

b) Automated Analysis and Decision Support Systems

With large volumes of taxpayer data, digital tax authorities utilize decision intelligence tools to ensure accurate enforcement and oversight.

– Dashboard Systems – visual interfaces presenting administrators with real-time tax data, audit outcomes, and compliance trends.

– AI-Based Risk Models in which machine learning algorithms identify patterns of potential tax evasion and prioritize cases for further audit (Bassey et al., 2022).

– Anomaly Detection via AI/ML. These systems flag irregular irregularities by comparing taxpayer behaviour against expected norms and historical baselines.

– Decision Support Systems (DSS) assist human officers in making structured and transparent enforcement decisions using multivariable input models (Martínez et al., 2022).

c) Integrated Tax Databases

Digital tax administrations rely on data centralization and cross-institutional integration for effective monitoring.

– Real-Time Data Flows represent continuous updates from state and private actors (e.g., employers, banks, and customs).

– System Integration is a linkage between tax, labour, customs, and financial institutions that enhances the scope and precision of enforcement (Reyes-Tagle et al., 2023).

– Taxpayer Portals – personalized digital accounts allow individuals and firms to access tax history, file returns, and receive system alerts.

d) Human-Centric Digital Services

To ensure taxpayer engagement and trust, digital tax systems also focus on user-centred interfaces and accessibility.

– Mobile Apps and Web Portals simplify tax declaration, e-payment, and submission of supporting documents.

– Customer-Oriented Design represents interfaces that are optimized for usability, multilingual support, and mobile responsiveness.

– Digital Identity Tools include secure authentication systems such as electronic signatures (e-signatures) and national digital ID schemes (e.g., ASAN İmza in Azerbaijan) to facilitate legally valid online transactions (Dhaliwal et al., 2023).

Key Technologies and Innovations

The successful implementation of digital tax administration systems depends on using emerging technologies, which automate tax processes, enhance data reliability, and reduce administrative burdens (Junquera-Varela et al., 2022; Martínez et al., 2022). Table 1 presents key technologies commonly used by tax authorities, their core application areas, and their expected impacts.

Table 1. Key Technologies and Innovations

Technology	Application Area	Expected Impact
Blockchain	Immutability and transparency of invoices	Prevention of fraud
AI / Machine Learning	Risk-based audits	Reduction of tax evasion
Big Data	Analysis of large volumes of data	Optimization of audit resources
Cloud Computing	Rapid scaling of services	Secure and sustainable data environment

Source: Author's analysis data (2025).

Each of these technologies supports one or more components of the digital tax ecosystem.

Blockchain ensures data immutability and verifiability, especially in e-invoicing systems. By providing tamper-proof records, it plays a significant role in preventing invoice fraud (Bunn et al., 2020).

Artificial Intelligence (AI) and Machine Learning (ML) are widely applied in risk-based audit selection and compliance scoring. These systems allow tax authorities to detect anomalies and focus audit efforts more efficiently (Bassey et al., 2022).

Big Data enables the integration and analysis of multiple data sources – from banking, customs, and third-party platforms – which supports predictive modelling and improves audit targeting (Mpofu, 2022).

Cloud computing provides the flexibility to scale digital services quickly and securely. It also improves system resilience and ensures business continuity during high-demand tax filing seasons (Reyes-Tagle et al., 2023).

These technologies are not only applied independently but are increasingly integrated into centralized platforms that allow for real-time data exchange, automated decision-making, and enhanced user experience (Dhaliwal et al., 2023).

Efficiency Criteria

Digital tax administration systems must be evaluated not only based on their technological implementation or rollout but also through well-defined, measurable efficiency indicators. These indicators help policymakers, tax authorities, and auditors assess digital transformation's true impact across various dimensions of public finance. In the literature, efficiency evaluation is often categorized under three key dimensions: economic, administrative (governance), and technological (Bassey et al., 2022; Junquera-Varela et al., 2022) (Figure 1).

Each of these dimensions reflects a unique perspective of performance. While economic criteria focus on revenue gains and cost reductions, administrative criteria relate to tax authorities' institutional and operational effectiveness, including response time, audit coverage, and transparency. Technological criteria, in contrast, examine system usability, scalability, cybersecurity, and interoperability of tax platforms (Reyes-Tagle et al., 2023).

Establishing a comprehensive set of efficiency criteria is vital not only for internal performance monitoring but also for ensuring accountability, comparability across jurisdictions, and data-driven reforms. The following sections provide an in-depth exploration of each dimension and its key performance indicators based on best practices from the OECD, the World Bank, and emerging market economies (Dhaliwal et al., 2023).

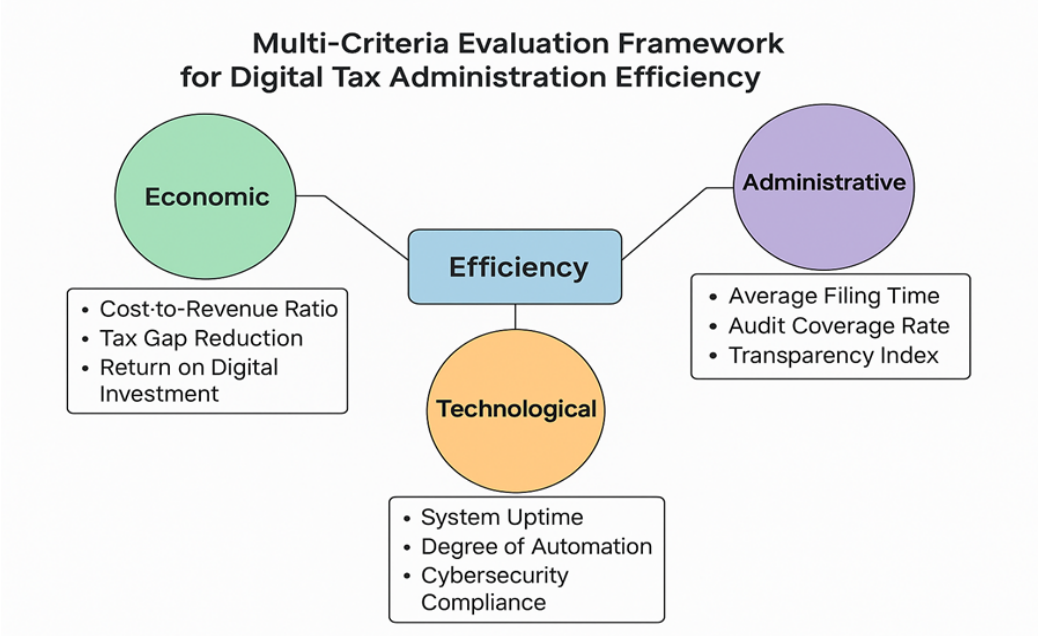

Figure 1. Digital Tax Administration Efficiency

Source: Author's analysis data (2025).

Economic Criteria

Economic efficiency is a guiding principle or key performance area in digital tax administration that determines how well the tax system generates revenue with the minimum cost of compliance and administration. The deployment of digital technologies can substantially reduce the cost of enforcement, increase voluntary compliance, and decrease the tax gap (Martínez et al., 2022). Below are several indicators that can be used to assess the economic efficiency of digital tax administration systems.

Cost-to-Revenue Ratio

It also represents the "cost" regarding tax authorities' resources compared to the amount of taxes collected. The lower the ratio, the more efficient the operation. Digital systems usually replace cumbersome manual processes, thus resulting in large cost savings. Martínez et al. (2022), OECD countries, reveal that administrative costs in tax agencies were reduced by 12–18% due to the launch of digital technologies.

Reduction of the Tax Gap

The tax gap, or the amount of potential tax revenues not collected, is the aim of digitisation. Automated reporting systems, e-invoicing, and real-time transaction monitoring enhance the visibility of tax activity, especially in high-risk sectors like retail and services. Bunn et al. (2020) reported that implementing electronic monitoring systems in such countries as Estonia and Spain caused a decrease in value-added tax (VAT) tax gaps from around 20% to below 10%.

Higher Willingness to Pay

At variance with these traditional forms of enforcement, digital tax systems strengthen voluntary compliance by simplifying tax filing, enhancing process transparency and diminishing the taxpayer's compliance burden. Better user experience promotes more voluntary taxpayer interactions and reduces reliance on enforcement through punishment. According to Reyes-Tagle et al. (2023), Estonia's digital tax platform allows faster tax filing in less than 5 minutes, has increased compliance and contributed significant cost savings for the system.

The economic efficiency of digital tax administration does not confine itself to immediate cost reduction; it also helps to ensure the long-term viability of public finance. Estonia's success in combining simplified filing systems with automation shows that lower operating expenses need not come at the cost of improved compliance or higher revenues, suggesting a model of fiscal resilience instead of the typical focus on the looseness of terms and conditions.

Governance criteria (Administration)

Administrative efficiency in e-tax characterizes the ability of tax administrators to efficiently manage institutional resources, enforce tax compliance, and foster fair, responsive communication with citizens. This dimension accounts not just for internal managerial competence but also for the level of flexibility by which authorities may adjust to taxpayers' changing demands and respond to evolving regulations (Junquera-Varela et al., 2022). Time efficiency, transparency, and monitoring power are core shield parameters to assess administrative performance.

Time Efficiency

In particular, automatic compliance, audit and tax compliance such as taxation returns, data checking and test selection, and reporting substantially reduce processing time for tax authorities and their taxpayers. By reducing interventions, governments can free up human resources to engage in more value-added activities, and taxpayers can get faster, more predictable results. For example, Estonia and Chile have implemented real-time tax declaration portals, which

decrease administrative turnaround by more than 70%, allowing quicker refunds and risk assessment (Reyes-Tagle et al., 2023).

Transparency

Digital tools, such as e-invoicing, e-taxpayer portals, and real-time dashboards, can add transparency by supporting stakeholders' ability to follow a transaction from its origin to its reporting. This kind of transparency narrows the space for informal manipulation, corruption and under-reporting, increasing the public's confidence in the tax system. Junquera-Varela et al. (2022) highlight that digital dashboard implementations in Latin America and Eastern Europe have enhanced the ability to trace tax data and support anti-corruption activities with built-in audit trails.

Control and Supervision Capacity

Good tax governance requires that tax systems are interfaced with other state databases: customs, labour registers, financial institutions and social security. Such cross-linkages can help tax authorities build a complete picture of taxpayer behaviour, enabling them to identify anomalies, enforce compliance, and develop specific policies. African revenue authorities that implemented real-time integration with mBanking and customs systems shared their success story with Mpofu (2022), narrating that such real-time integration led to over 50% reduction in manual review time and improved audit accuracy.

Case Example: Rwanda's Real-Time Mobile Taxation System

One successful example of administrative innovation is Rwanda's electronic tax system, which involves mobile-enabled tax payment and almost instant verification. It increased compliance rates and removed the delay of manual paperwork, leading to greater efficiency and satisfaction from the taxpayers (Bassey et al., 2022).

Technological Criteria

The information technology effectiveness of a digital tax system is the extent to which the system's technological architecture enables providing a set of secure, efficient, and citizen-centred products. A technologically strong backbone is necessary for the system's operation, stakeholder participation, and trustworthiness. Indicators should be adapted to the scope for which the cyber maturity levels of those entities are being aligned with, in this scenario: interactivity, automation, and compliance with cybersecurity (Dhaliwal et al., 2023).

Interactivity

In the digital era, tax systems should move away from static interfaces and offer a two-way relationship whereby taxpayers can interact with the tax administrations. These involve real-time alerting, mobile interactions, chatbot interaction, and dynamic FAQs. It also lowers the number of failures, improves the service response time, and increases the perception of fairness in the system. According to Dhaliwal et al. (2023), using an interactive queuing facility in a taxpayer portal does make a difference, such as increased timeliness of return submission and fewer service problem complaints.

Automation

Automation of the digital tax ecosystem is a clear reflection of technological maturity. Tools enable systems to take account of relevant data points and automate invoice checking, tax liability calculations, pre-filling of forms, and alerts. Automating the manual process relieves administrative staff from errors, speeds processing, and frees them up for well-thought-out decisions. Dhaliwal et al. (2023) stress that automation alleviates incoherence and provides scalable monitoring, especially pertinent in high-volume settings, such as annual filing seasons.

Cybersecurity

Because digital are repositories for sensitive taxpayer and financial information, their cybersecurity must be strong. Best practices cover end-to-end encryption, multi-factor authentication, and continuously scanning systems for vulnerabilities, aligning with international standards like ISO/IEC 27001. Security breaches are not only about money loss but also credibility loss. Bunn et al. (2020) showcase the Turkish e-invoicing platform as a state-of-the-art example of incorporating blockchain and encryption to safeguard transaction-level data and system integrity.

Case Example: Turkish Revenue Administration

Turkey's Revenue Administration launched an e-invoice system that uses a blockchain-based structure that guarantees the immutability and traceability of tax data. It is a high-throughput transaction system with state-of-the-art encryption and is a model for secure and efficient digital tax service in the region (Bunn et al., 2020).

Evaluation Metrics

Assessing the effectiveness of tax administration/management systems should also reflect outcomes-driven governance performance, financial results, and citizen-centric service quality. These performance measures can be used to measure the performance of the tax system, transparency, tax compliance, risk response, and public trust with a set of measurable factors (Bassey et al., 2022).

The opposite of conventional evaluation methods is digital assessment, which essentially works on dynamic, real-time analytics-based decision-making models. These applications are not only aimed at measuring a company's actual efficiency but also provide decision-making support for forecasting and strategic planning activities (Martínez et al., 2022). As a result, public organizations are able to systematically consider the organizational and diffusing dimensions of digital transformation changes.

This section examines three primary evaluation methods models.

Performance Indicators

Performance indicators (KPIs) are quantitative measures of a specific aspect of the tax administration system in the e-tax system. They usually include relevant dimensions such as resource usage, quality of service, compliance, and management flexibility. Real-time

tracking of these KPIs is important for efficient resource utilization and public accountability.

Risk-Based Assessment Models

These are models that use artificial intelligence, machine learning, and big data algorithms to identify and predict potential tax non-compliance and deviations. When used systematically and in 'real-time' investigations, such models facilitate a tax audit and inspection in a more resource-intensive and focused way (Dhaliwal et al., 2023).

Comparison Analysis (Pre/Post-Digital Transformation)

Comparison analysis (pre vs. post) compares the indicators before and after operations perform a digital transformation. Such analysis yields empirically grounded insights into the actual effects of reforms and is especially useful in terms of accountability and policy development. For example, average filing times or tax gap ratios from one year to the next can illustrate the system's increased efficiency.

Combining these three methodologies enables a framework for comprehensive assessment at the micro (operational level indicators) and macro (fiscal strategy and policy planning) levels. Thus, cobinding KPIs and risk-based approaches create an ideal basis for monitoring objective, continuous, and automatic performance. As Reyes-Tagle et al. (2023) stress, the intentional, systematic design of evaluation metrics directly impacts the quality of digital public services and citizen-centred decision-making.

RESEARCH METHODOLOGY

This study aims to determine the effectiveness of digital tax administration systems based on measurable factors and explain the impact of implementing some technological components on the system's manageability. The researcher uses a qualitative approach that involves analyzing a set of quantitative and qualitative data.

Data Collection

This study uses three sources of data collection.

a) Quantitative Data

Official statistics on the tax system's performance before and after digitalization will be collected. This covers the following indicators: electronic signature, tax revenues (before and after the introduction of electronic means), average audit and risk time, cost, income, and tax payment performance ratios. These data are obtained from the Ministry of Taxes, the State Statistical Committee, and international platforms (World Bank, OECD).

b) Survey Method

The goal of surveys is to quantify the ease of use, transparency, and quality of digital systems. The questionnaires will be arranged using a Likert scale and analyzed using statistical development analysis (programs such as SPSS or R).

c) Expert Interviews

Expert interviews are a qualitative research method that involves in-depth conversations with individuals possessing specialized knowledge and expertise in a particular field. The following questions will be asked during the interview:

– Where has digitalization proven to be more effective in the control system?

– What problems have arisen due to the installation of digital systems?

– How much does technology put back in?

Interviews will be coded using thematic analysis (thematic analysis) and analyzed for thematic content.

All data collected during the study will be anonymized, and the confidentiality of personal data will be protected. The study is carried out by the Azerbaijan Ethical Research Standards.

Analysis Methods

Table 2 presents the analysis methods of the collected data used in this study.

Table 2. Collected Data Analysis

Type of Data	Analytical Approach	Tools / Software
Statistical indicators	Comparative and trend analysis	Excel, SPSS, R
Survey results	Descriptive and correlation analysis	SPSS, JASP
Interview transcripts	Thematic content analysis	MAXQDA, NVivo

This methodology creates a flexible and reliable guarantee for analyzing actual performance and studying the subjective experiences of system employees.

Evaluation Models

Measuring efficiency indicators and applying specific analytical models for prioritizing decisions, inter-system comparison, and synthesis of multidimensional results are necessary. In this context, the following analytical evaluation models can be used to evaluate digital tax administration.

Data Envelopment Analysis (DEA)

DEA measures the relative technical efficiency of decision-making units (e.g., tax offices) with multiple input and output parameters. Based on mathematical programming, the DEA model determines a "best practice level" and compares other entities to this level (Martínez et al., 2022).

Inputs: administrative costs, number of employees, technological investments.

Outputs: tax collected, audit productivity, compliance rate.

With the DEA model, the efficiency of 10 regional tax offices can be compared, and resource use can be optimized.

Analytic Hierarchy Process (AHP)

AHP is a widely used multi-criteria decision-making method for weighting and prioritizing subjective criteria.

This model makes binary comparisons between criteria and calculates numerical priorities based on expert opinion.

For example, through AHP, weights can be assigned as follows: Economic efficiency – 50%, Management flexibility – 30%, and Technological sustainability – 20%. Systems can be ranked by calculating final scores.

The AHP approach is an efficient evaluation method based on decision-makers expert experience (Dhaliwal et al., 2023).

Multi-Criteria Decision Analysis (MCDA)

MCDA allows for the simultaneous evaluation of various alternatives on multiple (and sometimes conflicting) criteria. MCDA is mainly implemented by weighted aggregation, normalization, and KPI scoring methods.

Implementation process: criteria selection (e.g., revenue, relevance, level of automation), normalization of indicators for each criterion, assignment of weights (expert or statistical-based), construction of final scoring and decision table. MCDA is a valuable method for broader and more complex assessments (Reyes-Tagle et al., 2023).

Case Study: Digitalization of Azerbaijan Tax Authorities

The Republic of Azerbaijan has become one of the countries that has implemented a leading technological transformation in tax administration in recent years and has systematically organized the digitalization process in this area at the level of public administration. The main goal of this transformation was to formalize the economy and prevent informal activities by increasing the transparency, efficiency and compliance of the tax collection system.

Table 3. Impact of Digital Transformation on Key Performance Indicators in Azerbaijan's Tax Administration

Indicator	Before Digitalization	After Digitalization (2023)	Change (%)
E-filing submission rate	~40%	~95%	+55%
Average tax return submission time	~60 minutes	~8 minutes	−86%
Tax compliance rate	~65%	>85%	+20%
VAT gap	~20%	11.5%	−8.5%

Source: Author's data processed (2025).

As a result of digitalization measures, Azerbaijani tax authorities have significantly reduced processing costs, increased tax revenues, increased taxpayer satisfaction and optimized the efficiency of audit resources. Both KPIs and multi-criteria decision-making have objectively confirmed these results (Table 3). The study shows that the Azerbaijani case can be considered a model practice for digital tax administration on a regional scale.

RESULTS AND DISCUSSION

Analysis Findings

The MCDA and KPIs results implemented in the research context reveal that digital tax administration systems are not only subject to technological development. On the other hand, they imply profound and substantial developments in management capacities, degree of transparency, and fiscal indicators. The measurements that have been made prove that, due to digitalization, the tax administration has become a more limber, more transparent and result-focused model of management with real-time coverage of the income tax assessments, the commencement of automated reconciliations, reduction in interaction with the taxpayer through e-services, and the system itself being more fiscally sustainable.

Such findings indicate that going digital in the tax administration is more than merely a technology upgrade; it is really a process of institutional and strategic change. Systems are no longer merely information collection and processing systems but have evolved into analytical, predictive, and citizen-focused decision-support systems.

The KPIs and the MCDA model implemented in the research demonstrate that digital tax administration tools not only speed up technical processes but also bring real benefits in optimizing budget revenues, reducing the tax gap, and efficiently managing administrative costs.

Notably, fiscal discipline is reinforced by the strong state tax collection and reporting system, which is centralized around tax information collection and electronic submission, as well as automated analysis.

The economic and fiscal impact of these changes is as follows.

The Lower Cost of Transactions

The cost of transactions in a traditional (manual and paper-based) tax system is much higher than in a digital one. Electronic declarations, automatic patrimonial systems, and e-audits minimize labour resources and time loss. According to the OECD and the World Bank, reduced administrative tax costs by 15–30% in some countries (Martínez et al., 2022) are some examples of certain results.

Closing the Tax Gap

Electronic control instruments – particularly e-invoices, real-time sales data, and data integration (banking, customs, etc.) – enhance the visibility of the tax system. This is to shrink the shortfall between the amount of tax collected and the amount of tax due, mainly regarding VAT and corporate income tax. In certain countries (Estonia, Turkey, Chile), the difference decreases between 5 and 10% of the cases (Reyes-Tagle et al., 2023).

Higher Tax Collections

As more compliance comes with digitalization, there is real growth in tax collections. Basic systems (mobile application, pre-filled form) reinforce voluntary payment practice and attitude, especially for MSMEs). This is

especially significant in less developed countries with large informal economic sectors.

Return on Investment (ROI)

The return on the IT investments, or rate of return on the implemented systems, was evaluated through the MCDA matrix in the research. The results demonstrate that a high technical and structural cost at the outset is compensated in the medium term, and the ROI is positive in 3–5 years (Dhaliwal et al., 2023).

Analysis of the economic and fiscal dimensions demonstrates that digital tax administration systems not only reduce operating costs but also massively contribute to creating the tax culture, increasing voluntary compliance, and funding the state budget overall. Thus, digitalization is a political instrument not just from a technical but also from an economic policy point of view.

Discussion

The research results indicate that digital tax administration is not just a means of technological modernization for contemporary public sector administration. Still, it is a strategic instrument that enhances institutional flexibility, fiscal sustainability, and service quality and is oriented towards citizens. The empirical evidence collected and the evaluation models applied confirmed that the systems have a significant institutional value in terms of efficiency and effectiveness.

The research addresses a theoretical missing link in the literature, with the proposed structured methodology (MCDA + KPI) standing out in terms of the current approaches to the impact of digitization in the tax system. Whereas traditional studies predominantly examine digitalization from a technological perspective, the measurement of digital systems in the domain of management effectiveness, economic indicators and strategically oriented institutional changes bridges onto a differentiated scientific view.

Research findings agree with Junquera-Varela et al. (2022), Martínez et al. (2022), and Dhaliwal et al. (2023) that digitalization is not only technology but a result-based transformation in management.

The digital tax administration systems enable tax administrators to make objective, information-driven, and predictable operational and strategic management decisions. Performance can be monitored faster using KPI and risk-based monitoring, and interventions at the policy level can be made faster.

In developed countries, the effect of digitalization is reflected more in process optimization and quality of the audit and in developing countries, expanding the tax base and decreasing the informal economy. In this regard, the Azerbaijan experience can also be seen as a best practice for other regional and middle-income countries.

CONCLUSIONS

The purpose of this study was to determine the effectiveness of digital tax administration systems based on measurable factors and explain the impact of implementing some technological components on the system's manageability. Using the Multi-Criteria Decision Analysis (MCDA), Key Performance Indicators (KPI) to analyze the various effects of the implementation of the digital tax administration systems allowed us to identify the following:

– The fiscal implications of digitalization are important in containing the cost of administration, increasing revenue spending and closing the gap.

– Automated processes and real-time monitoring improve transparency and agility in control management and facilitate the implementation of risk-based audits;

– The delivery of digital taxpayer services has been a central contributor to improved user experience, which fosters voluntary compliance and enhances the trust between the citizen and the state;

Digitalization is not limited to information technology but aims for a predictive and decision-support-managed system. The Azerbaijani case demonstrates that digital solutions such as e-invoice, e-cash, and integration between API, personal cabinet, and ASAN signature have helped to improve the tax compliance level by contributing to a decrease of the tax gap and a streamlining of tax declaration submission. This is a successful example that can influence the other countries in the region.

This study helps deepen our understanding of the practice and theory of digital tax governance and offers considerable evidence for future tax policymaking.

Recommendations

Successful implementation of digital technologies requires the development of the national legal and administrative side of the digital strategy, which includes updating tax legislation. In addition, digital transformation requires human capital to be aligned. In particular, an essential component of this process is the digital literacy of tax authorities and taxpayers to use technological instruments better. KPIs should be used as the foundation for a sustainable and transparent evaluation system. For automated monitoring of KPIs and to enhance public accountability, open data boards need to be evolved.

Even more serious efforts are needed toward secure and inclusive technological infrastructure based on cyber protocols following international data protection standards. International cooperation on sharing experience in digital tax administration will help accelerate digital technology implementation in less developed countries.

The above conclusions and suggestions confirm once more that digital tax administration is not only a new technical stage but also a new stage in the philosophy of management, citizen of service, and state planning strategy. Successful practice will no doubt depend on technical innovation but must also come with political will, social inclusiveness, and management transparency.

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