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Methodological Framework for Evaluating AI-Driven Digital Transformation in Accounting and Tax Administration

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Abstract

This study develops a rigorous methodological framework for integrating artificial intelligence (AI) into accounting and taxation systems using expert evaluation approaches. Based on a systematic review and critical synthesis of recent academic literature, the research refines the conceptual foundations of AI and clarifies its functional role in the digital transformation of accounting practices and tax administration. The study identifies key domains of AI application, including robotic process automation in accounting operations, intelligent accounting information systems, predictive fiscal analytics, and AI-driven virtual assistants supporting tax compliance and reporting. Particular emphasis is placed on expert-based assessment tools—such as Delphi and multi-criteria methods—to evaluate effectiveness, institutional readiness, and digital maturity of AI-enabled systems. The findings demonstrate that AI adoption serves as a systemic driver of digital modernization, enhancing operational efficiency, analytical reliability, transparency of fiscal processes, and adaptability of regulatory mechanisms. The proposed framework contributes to the development of evidence-based, data-driven governance models in public finance and corporate accounting.

Keywords: Accounting, taxation, artificial intelligence, digital transformation, tax administration, expert evaluation.

Introduction

In the contemporary economic environment, accounting and taxation constitute core elements of organizational management, ensuring the formation of reliable, comprehensive, and timely information on economic operations, asset composition, financial results, and tax liabilities. Possessing advanced professional competencies and analytical expertise, accounting specialists are increasingly engaged in the identification and assessment of financial and tax risks, the development of mitigation strategies, the optimization of tax burdens and operating costs, and the analytical support of strategic decision-making. Consequently, the professional role of accountants has evolved beyond conventional bookkeeping functions toward analytical, consultative, and strategic responsibilities, positioning them as key participants in managerial processes while simultaneously ensuring compliance with statutory and regulatory requirements.

Under conditions of accelerated digitalization, the expansion of remote and hybrid work formats, and the rapid advancement of information technologies, the application of artificial intelligence (AI) in accounting and taxation has attracted growing scholarly and practical interest. Artificial intelligence encompasses a set of technologies, models, and algorithms aimed at developing intelligent systems capable of performing data processing, forecasting, analytical evaluation, and decision-support functions that were previously executed

predominantly by human experts. The convergence of automation technologies with AI-based analytical tools creates new opportunities to enhance the accuracy, consistency, and timeliness of financial and tax reporting, streamline accounting workflows, reduce operational and compliance-related risks, and increase the overall productivity and adaptability of accounting functions.

In the context of rapid global scientific and technological progress, competition for leadership in the field of artificial intelligence has become a significant strategic priority. Many countries, including the United States, China, Japan, Australia, Brazil, Canada, Russia, and a number of European states, are actively integrating AI technologies into economic governance and public administration systems, while simultaneously developing legal, ethical, and regulatory frameworks governing their application. Within this global landscape, the implementation of artificial intelligence in accounting and taxation has emerged as a strategically important area of academic research and policy-oriented analysis.

A substantial and growing body of academic literature reflects sustained interest in the application of artificial intelligence in accounting, taxation, and public finance. International researchers, including David Autor, Richard Susskind, Edward Felten, Michael Jordan, A. Spielman, A. Konushin, V. Malykh, A.A. Udalova, A.V. Sosnovskaya, and A.S. Andyka, have examined diverse aspects of AI-driven transformation in taxation, professional services, and financial management. In

Uzbekistan, this research trajectory has been actively developed by S.S. Gulyamov, Sh. Mirzaev, U. Yuldashev, M. Kamilova, B. Salimov, S. Bekmurodov, Sh. Tursunov, and A. Abdugafarov, whose contributions significantly expand the theoretical, methodological, and applied foundations for the use of artificial intelligence in accounting and tax systems.^[1, 8] The diffusion of digital technologies has fundamentally reshaped economic systems and accounting practices, transforming traditional business models, organizational structures, and information flows. These transformations necessitate the adaptation of accounting and management methodologies to data-intensive, algorithm-driven, and technology-mediated environments. At the same time, the integration of artificial intelligence into accounting and taxation is associated with a number of constraints, including the complexity of processing large and heterogeneous datasets, institutional resistance to innovation, limited trust in automated decision-making, shortages of appropriately skilled personnel, and high initial implementation costs. Despite these challenges, empirical evidence indicates a steady expansion in the adoption of AI technologies not only among large corporations but also among small and medium-sized enterprises, particularly in the automation of accounting data collection, processing, and tax-related procedures.

Crucially, the effective and responsible implementation of artificial intelligence in accounting and tax systems requires a scientifically substantiated methodological framework capable of assessing feasibility, effectiveness, and potential risks associated with AI-based solutions. In this context, expert evaluation methods assume particular importance, as they enable the systematic incorporation of professional judgment into the analysis of AI adoption processes, especially under conditions of regulatory complexity and informational uncertainty. Expert-based approaches provide a structured analytical foundation for assessing organizational readiness for AI integration, determining the functional relevance of specific AI tools, and forecasting their impact on accounting efficiency and the performance of tax administration mechanisms.

In sum, artificial intelligence technologies possess substantial transformative potential for accounting and taxation systems. The development and application of expert-oriented methodological frameworks represent a necessary prerequisite for the effective, transparent, and sustainable implementation of AI technologies, as well as for advancing the digitalization and intellectualization of accounting, taxation, and audit processes in the modern economy^[6, 10].

Materials and Methods

The scientific novelty of this study lies in the development and empirical validation of a comprehensive methodological framework based on expert evaluation for the analysis of artificial intelligence (AI) and advanced digital solutions in accounting and taxation systems. The proposed framework substantiates the feasibility and effectiveness of adopting AI-oriented instruments, enhances the analytical foundation of digital transformation initiatives, and contributes to the improvement of tax administration and control mechanisms, taking into account prevailing institutional, organizational, and regulatory conditions.

The research demonstrates that, despite formal compliance with regulatory requirements at the operational level, the quality, sustainability, and functional effectiveness of digital technologies and interactive tax services in the Republic of Uzbekistan do not fully correspond to internationally recognized benchmarks. This gap reflects the existence of

methodological, institutional, and regulatory inconsistencies between implemented technological solutions, the normative legal framework, and their practical realization within tax administration processes.

From a methodological perspective, the study places particular emphasis on the identification and evaluation of institutional risks associated with the introduction of digital technologies and artificial intelligence in tax administration. These risks include governance asymmetries, informational imbalances, and the potential disproportionality between implementation costs and achieved socio-economic outcomes. Addressing these challenges requires the application of objective and analytically rigorous instruments based on the systematization of expert judgments and the use of quantitative multi-criteria evaluation indicators.

The study employs a phased “bottom-up” approach to the integration of digital technologies and AI into the tax system of the Republic of Uzbekistan. This approach presupposes the gradual incorporation of modern software solutions, analytical platforms, and communication technologies into the existing institutional infrastructure in accordance with current legislation and state examination procedures. The effectiveness of implemented digital and AI-based solutions is assessed through structured expert evaluation methods that take into account sector-specific characteristics, regulatory constraints, and the practical experience of professionals in accounting and tax administration.

The empirical component of the research is based on a selective expert survey conducted in 2023 in the city of Samarkand, involving more than 12 highly qualified specialists in the fields of tax legislation, accounting, and digital technologies. A dedicated working group was established to design and administer the survey instruments, while a separate expert group was responsible for processing the collected data, calculating aggregated indicators, and determining the weight coefficients of evaluation factors.

The questionnaire consisted of 10 evaluation parameters measured on a ten-point scale, where a score of 1 corresponded to minimal significance and a score of 10 indicated maximal significance of the assessed criterion. This scaling ensured the comparability and consistency of expert judgments and enabled the construction of integral performance indicators. The evaluated parameters included:

- i). Effectiveness of implemented digital technologies and software solutions in accounting and taxation;
- ii). Transparency and clarity of tax and accounting legislation;
- iii). Quality of interactive public services delivered through official tax portals;
- iv). Professional competence of tax authority management and personnel;
- v). Adequacy of the overall tax burden;
- vi). proportionality and justification of penalty sanctions for Violations of tax legislation;
- vii). Feasibility of optimizing the number of taxes and mandatory payments;
- viii). Effectiveness of coordination mechanisms for tax audits;
- ix). Impact of expanding e-government services on the reduction of institutional risks; and
- x). Existence of systemic constraints in the activities of tax authorities.

The processing of expert survey data was carried out using weighted aggregation techniques, which enabled the calculation of integral indicators for each analytical dimension while accounting for their relative significance. The applied

methodological toolkit ensures objectivity, internal consistency, and applied relevance of the obtained results, forming a scientifically grounded basis for evaluating the effectiveness of AI technologies and digital solutions in accounting and taxation systems.

Expert evaluation methods play a central role in improving the effectiveness of management systems within tax administration structures. In the present study, expert-based assessment is employed to analyze both the quality of contemporary tax control instruments and the effectiveness of AI applications in accounting and taxation. The relevance of expert methods is particularly pronounced in research contexts characterized by limited statistical data availability, incomplete reporting information, or constraints on direct quantitative measurement of complex institutional processes, thereby confirming their methodological validity and practical applicability [11, 17].

Research Analysis

In the analysis of complex socio-economic and institutional phenomena, heterogeneity in expert judgments is methodologically inevitable due to differences in professional experience, sectoral specialization, and individual interpretative perspectives. Therefore, a critical analytical task is to determine the degree of consistency and coherence among expert evaluations. The measurement of agreement among experts serves not only as a mechanism for validating aggregated results but also as an instrument for identifying potential sources of divergence, thereby enhancing the reliability, internal validity, and robustness of the research findings.

To evaluate the level of concordance among expert assessments, the study applies the Kendall coefficient of concordance (W), a widely recognized non-parametric statistical indicator used to measure the degree of agreement among multiple experts evaluating the same set of criteria. The coefficient takes values within the interval [0;1], where values approaching 1 indicate a high level of agreement, and values close to 0 reflect weak, inconsistent, or random judgments. The use of Kendall’s W enables a formal quantitative verification of the coherence of expert opinions prior to the aggregation of results and their substantive analytical interpretation.

In addition to Kendall’s W, the study employs the coefficient

of variation (V) to assess the dispersion of expert evaluations for each indicator. This coefficient represents the relative variability of expert scores and is calculated as the ratio of the standard deviation to the arithmetic mean, expressed as a percentage. Lower values of the coefficient of variation indicate a higher degree of homogeneity and stability of expert judgments, whereas higher values reflect increased variability, which requires cautious interpretation and, if necessary, additional analytical verification.

For interpretative purposes, the strength of agreement and the degree of consistency among expert evaluations are further classified using the Chaddock scale, which provides a qualitative interpretation of correlation strength. According to this scale, coefficient values below 0.3 correspond to weak agreement; values in the range of 0.3–0.5 indicate moderate agreement; values of 0.5–0.7 reflect noticeable agreement; values between 0.7 and 0.9 denote high agreement; and values exceeding 0.9 correspond to very strong agreement. The application of the Chaddock scale enhances the interpretability and methodological transparency of the obtained results within the broader analytical framework.

The combined use of Kendall’s coefficient of concordance, the coefficient of variation, and qualitative interpretation based on the Chaddock scale ensures a comprehensive and methodologically rigorous assessment of expert agreement. This integrated statistical-analytical approach allows for the validation of expert-derived data, supports the calculation of weighted aggregate indicators, and provides a robust empirical basis for evaluating the effectiveness of digital technologies and artificial intelligence in accounting and tax administration systems.

The empirical basis of the analysis is formed by the results of an expert survey conducted in Samarkand for the 2022 reporting period. The survey involved 12 experts representing private sector entities, public institutions, and governmental organizations, who evaluated 10 key indicators related to digitalization, artificial intelligence, and tax administration. The expert assessments summarized in Table 1 constitute the primary dataset for subsequent calculations of concordance, variability, and integral performance indicators characterizing the effectiveness of AI-driven and digital solutions in accounting and taxation systems [7, 12].

Table 1: Expert scoring assessment of factors

Factors	Experts												Sum ranks	Deviation from the average sum of ranks	The squares of deviations of the sum of ranks
	1	2	3	4	5	6	7	8	9	10	11	12			
1	4	3	4	3	3	4	3	3	3	3	4	4	41	-36	1296
2	3	4	5	4	3	3	4	3	4	4	4	3	44	-33	1089
3	5	4	3	5	4	4	4	3	4	3	3	4	46	-31	961
4	3	4	3	3	4	5	5	3	4	3	5	4	46	-31	961
5	7	9	9	8	9	7	6	8	9	7	9	8	96	19	361
6	7	7	9	7	9	7	8	9	7	9	7	9	95	18	324
7	8	9	7	9	7	9	8	7	9	7	9	7	96	19	361
8	8	8	8	9	8	9	8	9	9	8	8	8	100	23	529
9	8	9	8	8	9	9	8	9	8	9	9	9	103	26	676
10	9	9	8	9	9	8	8	9	8	9	7	9	102	25	625
Total	62	66	64	65	65	65	62	63	65	62	65	65	769	-	7183

The processing of the assessments begins after the data from the experts have been collected. The data are summarized, and

average values for each set of S_j-questions are calculated. To establish a quantitative evaluation of the factors, a simple

ranking method is employed. Table 1 provides a general overview of the results compiled into a single table. The consolidated expert opinion is obtained using mathematical statistics, and the average rank of each factor, or the mean statistical value of S_j , is determined.

$$S_j = \frac{\sum_{i=1}^n a_{ij}}{m_j} \quad (1)$$

S_j is the average value of the factors.

a_{ij} is the expert's assessment of the j -factor.

m_j is the number of experts evaluating the j -factor.

i - is the expert's number.

j - is the factor's number.

The next step is to determine the average rank of the set of factors in the research

$$\bar{S} = \frac{\sum_{j=1}^n S_j}{n} \quad (2)$$

The next step is to calculate the deviation of the average rank of the d_j -th factor from the average rank of the set of factors

$$d_j = \bar{S} - S_j \quad (3)$$

Table 1 presents the results of the calculation of actual data. Determining the consistency of expert opinions was an important part of the study. For this purpose, the concordance coefficient K was calculated using the formula

$$K = \frac{12 \cdot \sum_{j=1}^n d_j^2}{m^2(n^3 - n)} \quad (4)$$

The obtained values allow for the calculation of the concordance coefficient and enable the conclusion of the degree of agreement among expert opinions based on the Chaddock scale (Table 2).

$$K = \frac{12 \cdot 7183}{12^2(10^3 - 10)} = \frac{86196}{142560} = 0,61.$$

The obtained value of 0.61 is close to one, indicating a notably high level of agreement among expert opinions. This value of the concordance coefficient suggests that the experts' opinions are consistent, and therefore, the quality of the assessment can be considered significantly high. The strong consensus among experts reflects the reliability of the data obtained. As a result, the assessment process effectively identified the most modern and effective methods for integrating digital technology into the tax structure [4, 12].

Table 2: The Chaddock scale for evaluating the coherence of professional judgements

Quantitative Measure of Correlation Strength	Qualitative Characterization of Bond Strength
0,1 - 0,3	Weak
0,3 - 0,5	Moderate
0,5 - 0,7	Noticeable
0,7 - 0,9	High
0,9 - 1,0	Very high

Discussion

The empirical observations conducted in Samarkand indicate

that expert assessments provide a generally favorable evaluation of the quality and effectiveness of contemporary tax control instruments, as well as the current level of application of artificial intelligence (AI) technologies in accounting and taxation. The statistical analysis of digitalization processes and AI adoption confirms that expert-based evaluation constitutes an appropriate and methodologically robust approach for monitoring the performance, reliability, and service quality of interactive digital platforms operated by tax authorities, particularly in institutional environments characterized by regulatory complexity, informational asymmetry, and limited availability of standardized performance indicators.

The obtained results substantiate the feasibility of employing expert evaluation as a core analytical instrument for updating and improving the regulatory, methodological, and organizational framework of the tax system of the Republic of Uzbekistan. The empirical findings support the conclusion that the integration of digital technologies and AI into tax administration and interactive services should be implemented in a systematic, phased, and institutionally coordinated manner. The key preconditions for effective implementation include: (i) the active involvement of highly qualified specialists in the design, deployment, and maintenance of AI-driven and digital solutions; (ii) the optimization and consolidation of information flows through the development of integrated data infrastructures and the strengthening of cybersecurity mechanisms within tax information systems; and (iii) the provision of transparent, user-oriented, and high-quality public services for taxpayers through advanced digital platforms.

The results also highlight the strategic importance of benchmarking international best practices for the development of updated regulatory standards, technical protocols, and methodological guidelines governing the application of digital technologies and artificial intelligence in tax administration. Ensuring alignment with both national regulatory requirements and internationally recognized standards represents a necessary condition for improving the reliability, interoperability, and long-term sustainability of digital tax infrastructure. Moreover, the development of new methodological standards grounded in international experience contributes to enhancing the economic efficiency and investment justification of digital transformation projects in the fiscal sphere.

From a broader macroeconomic and institutional perspective, the study underscores the necessity of supporting innovative enterprises involved in the development of national digital infrastructure and promoting market-based evaluation mechanisms that consider available financial, technological, and human resources in assessing the effectiveness of digital technology implementation. The integration of advanced tax calculation models, analytical instruments, and risk-assessment tools into unified information systems can significantly improve the transparency, analytical capacity, and accountability of tax administration bodies. In this regard, the introduction of AI-driven analytical modules and predictive risk management systems enhances the capability of tax authorities to detect non-compliance, optimize audit procedures, and improve revenue administration outcomes. Overall, the findings confirm that the application of modern approaches to the integration of artificial intelligence and digital technologies possesses substantial potential for strengthening the functional efficiency, institutional credibility, and social relevance of the tax system. The proposed methodological framework and empirical results provide a scientifically grounded basis for further

modernization of accounting, taxation, and audit processes and contribute to the formation of a data-driven, adaptive, and innovation-oriented model of public financial governance in the Republic of Uzbekistan ^[5, 11].

Conclusion

The findings of the study demonstrate that the integration of artificial intelligence (AI) into accounting and taxation systems significantly reduces routine workloads for specialists by improving the accuracy of calculations and forecasts and by strengthening data-driven decision-making processes. The implementation of AI-based tools enhances organizational control over financial operations, reduces the probability of human error, and generates measurable time and cost efficiencies. The deployment of robotic process automation and intelligent accounting systems not only increases operational productivity but also facilitates the reallocation of human resources toward higher value-added activities, including analytical assessment, advisory services, and strategic financial management.

The expanding use of artificial intelligence has become a structural component of contemporary accounting and financial management, forming the technological basis for deeper digital transformation within organizations. The emergence of virtual accounting agents and intelligent financial platforms enables the automation of repetitive and standardized procedures, increases organizational flexibility, and allows professionals to focus on complex tasks related to tax planning, regulatory compliance, financial diagnostics, and risk analysis. These developments contribute to strengthening financial resilience, improving the quality of managerial decision-making, and creating favorable conditions for further advancement in data governance and analytical capacity.

At the same time, the research confirms that the complete automation of accounting and taxation processes remains neither feasible nor economically justified in the foreseeable future. This limitation is обусловлено финансовыми ограничениями, институциональными барьерами, сложностью отдельных налоговых и бухгалтерских операций, а также ограничениями искусственного интеллекта в задачах, требующих профессионального суждения, контекстуальной интерпретации и креативного мышления. Consequently, human expertise continues to play a decisive role in strategic decision-making, complex tax analysis, and the development of innovative financial and fiscal management solutions.

The results of the study allow for the identification of key challenges and the formulation of practical recommendations aimed at improving the application of AI in accounting and taxation systems. The integration of artificial intelligence should therefore be interpreted not merely as a technological upgrade but as a multidimensional socio-economic transformation encompassing institutional, organizational, and human capital dimensions. The success of this transformation depends on a balanced combination of technological innovation, institutional modernization, regulatory adaptation, and continuous investment in highly qualified human resources.

From a policy perspective, the proposed methodological framework and empirical findings provide a scientifically grounded basis for the modernization of accounting and tax administration in the Republic of Uzbekistan. The development of unified digital platforms, the expansion of AI-driven analytical tools, the strengthening of cybersecurity and data governance systems, and the enhancement of professional

competencies among accounting and tax specialists constitute key priorities for ensuring the long-term sustainability, transparency, and efficiency of the national tax system. In summary, the integration of artificial intelligence and digital technologies into accounting and taxation systems represents a strategic direction for improving institutional efficiency, enhancing fiscal transparency, and strengthening economic governance. The results of this research confirm the substantial potential of AI-driven transformation to support the sustainable development of accounting and tax administration and to contribute to the long-term socio-economic growth of the Republic of Uzbekistan ^[9, 17].

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