Облік і оподаткування

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ROLE OF DIGITAL TOOLS IN ENHANCING THE ACCURACY OF TAX LIABILITY CALCULATIONS

Summary. *In this article, the relevance of studying the impact of digital tools on the accuracy of tax liability calculations in the context of rapid digitalization of tax administration is substantiated, as evidenced by a 17–23 percentage-point increase in the share of electronic filings over the last decade and online payments covering approximately 90% of transactions. The objective of this work is to analyze how a suite of digital technologies shapes a proactive tax-compliance model and mitigates risks of errors and penalty assessments. The novelty of the research lies in integrating a multichannel approach, combining quantitative analysis of OECD, IRS, and HMRC statistical data with a systematic review of analytical reports from the IMARC Group and EY TFO-2024, the scientific publications of S. Swenson, and a content analysis of RPA implementation practices. A unified methodological model is proposed to evaluate the effectiveness and potential risks of each technology within the end-to-end digital loop document → validation → correction. Key findings indicate that unified digital identification is used by 81–100% of individuals and nearly 90% of companies. In the United States, 93.3% of tax returns are filed electronically, which significantly reduces manual-entry errors.The e-invoicing market is already at $15.9 billion. Analytical AI models accurately predict tax payments with up to 90% accuracy, thereby reducing the need for adjustments.*

More than 50% of large enterprises have implemented RPA solutions in tax processes, resulting in double-digit decreases in manual reconciliation costs. The integration establishes a continuous cycle for data upload verification and correction, thereby reducing human error and facilitating a transition from reactive to predictive risk management. This article will be beneficial to tax authority executives, tax compliance specialists, financial analysts, and developers of digital tax solutions.

Key words: *digital tools, electronic document management, digital identification, e-invoicing, artificial intelligence, Big Data, robotic automation, tax-calculation accuracy, tax compliance.*

Introduction. The accelerating digitalization of tax administration is radically changing the very nature of liability calculations: over the past ten years, the share of electronic filings across all major tax categories has increased by 17–23 percentage points, and online payments already cover approximately 90% of transactions; moreover, the use of virtual assistants and artificial intelligence in tax authorities has almost doubled since 2018 [1].

However, the scale of potential losses from inaccuracies remains colossal. In the United States alone, the projected tax gap—the difference between actual assessments and what is paid on time—is estimated at $696 billion for 2022, while the voluntary compliance rate stands at 85% [2]. In the United Kingdom, in early 2025, 1.1 million individuals failed to file their returns on time, risking an immediate fine of £100 and subsequent escalating penalties—the potential sum of initial sanctions alone reaches £110 million [3]. These figures indicate that even with a mature infrastructure, errors and delays translate into significant financial and reputational risks.

Against this background, the study focuses on how digital tools—from e-invoicing to AI-based predictive platforms—enhance the accuracy of tax-liability

calculations and reduce the likelihood of penalty assessments, thereby forming a new proactive model of tax compliance.

Materials and Methodology. The materials and methodology of the study stem from the critical analysis of nine sources. Comparative OECD data on digitalization of tax administration [1] and IRS statistics on electronic filing volume and the U.S. tax gap [2; 4] form the theory basis. Penalty enforcement timeliness and late reporting magnitude data came from HMRC and The Guardian [3]. Indicators of digital identification adoption were drawn from the OECD report on digital transformation initiatives [5]. The dynamics of the e-invoicing market were examined using IMARC Group analytics [6], the impact of generative AI on tax processes was assessed via the EY TFO-2024 survey [7], the accuracy of predictive models was evaluated according to S. Swenson [8], and RPA-implementation practices were analyzed using an industry report [9].

Methodologically, the research combines several approaches. First, quantitative statistical data (OECD [1], IRS [2,4], HMRC [3]) were used to appraise the dynamics of e-filing and online payments and correlate the tax gap with levels of voluntary compliance. Second, predictive and analytical reports (IMARC [6], EY [7], Swenson [8]) were systematically reviewed to identify trends in the growth of e-invoicing, the use of AI models, and the consistency of their validation. Third, a content analysis of RPA implementation practices was conducted, comparing data on automation levels and error reduction in calculations [9]. Finally, the results of all stages were integrated into a unified methodological model, which combines a comparative analysis of technologies and platforms with an assessment of their practical effectiveness and potential risks.

Results and Discussion. Electronic document management has become a foundational element of the digital tax ecosystem. In the United States, the share of individual returns filed via e-file reached 93.3% in 2024 — that is, 150.8 million out of 161 million processed forms, which virtually eliminates manual

entry and its associated arithmetic errors [4]. As Fig. 1 shows, in approximately two-thirds of jurisdictions, between 81% and 100% of individuals use a digital identity to access secure digital services offered by the tax administration. This uptake is even greater for firms, with almost 90% of administrations saying that over 80% of businesses use a digital ID. This ability enables tax authorities to automatically obtain and match the correct payment information with the applicable legal rates immediately [5]. Such a trusted data layer supports later detailed checking tools.

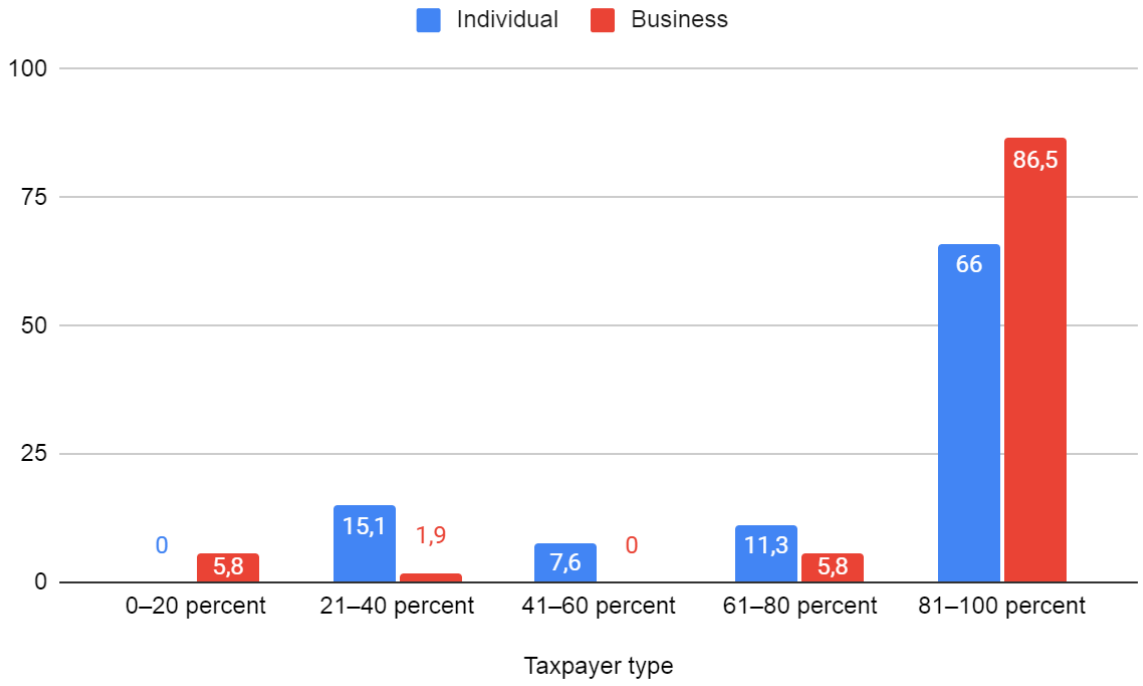

Fig. 1. Calculated share of the taxpayers who use a digital ID to get secure online services from the government in 2024 [5]

The next level is e-invoicing: the global electronic-invoice market is already valued at $15.9 billion and is forecast to grow more than fourfold by 2033, reflecting the accelerated regulation of mandatory digital invoices in the EU, Latin America, and Asia [6], as illustrated in Fig. 2.

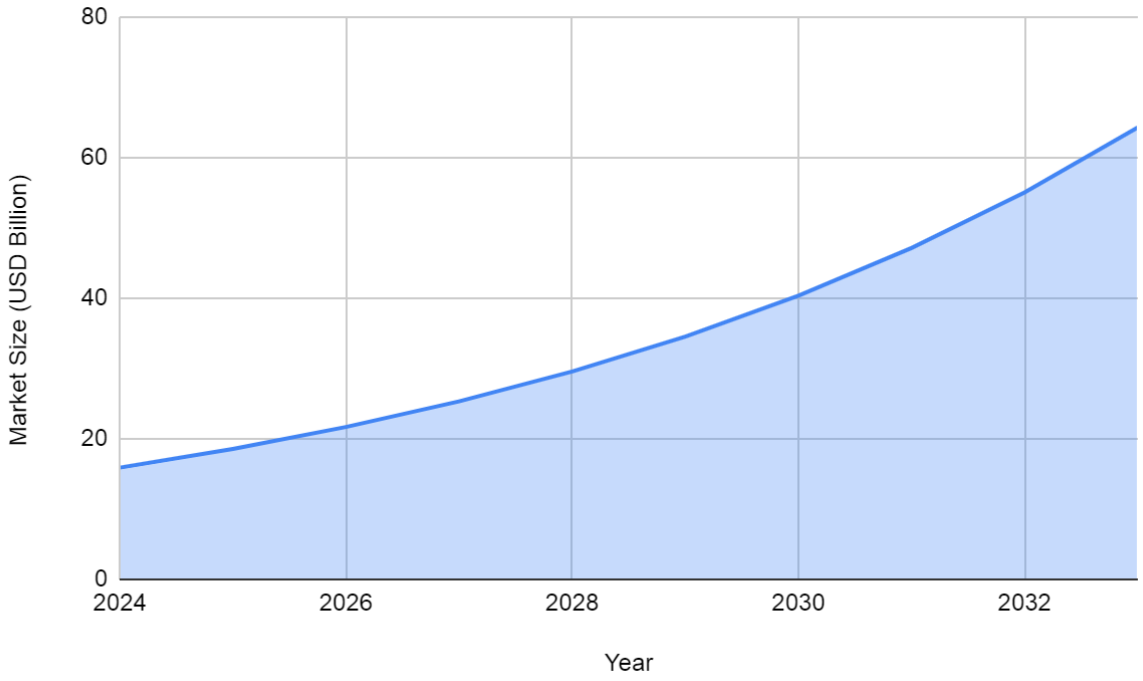

Fig. 2. Forecast of Global E-Invoicing Market Size [6]

End-to-end traceability of the invoice → return chain eliminates discrepancies between procurement and revenue data, and built-in checksums instantly block duplicates or suspicious adjustments before they enter the tax base.

Analytical Big Data platforms and AI models operate on these clean transactional datasets. In the EY TFO-2024 survey, 87% of tax-function leaders expect generative AI to enhance departmental efficiency, although 75% assess their current practice as still experimental [7]. Concurrently, academic research demonstrates a practical impact: neural networks and tree-ensemble models predict quarterly corporate tax payments with approximately 90% accuracy, outperforming traditional regressions and reducing the volume of subsequent adjustments [8].

To scale these calculations, organizations are deploying robotic process automation (RPA) and voice assistants: study [9] reports that 53% of companies have already launched RPA scenarios in tax processes, and another 19% plan to do so within the next two years; 78% of existing users intend to expand their

investments, citing double-digit reductions in manual-reconciliation costs, as shown in Fig. 3.

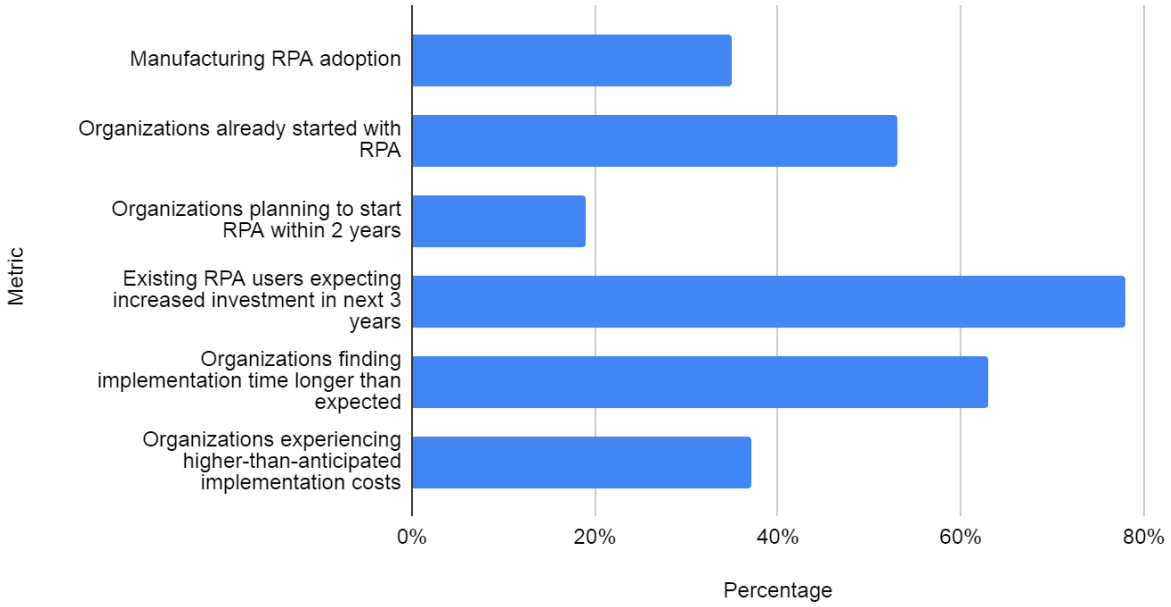

Fig. 3. RPA Adoption and Implementation Metrics [9]

By integrating RPA with predictive analytics, companies establish a continuous loop of data ingestion → machine validation → corrective entries, where human intervention is required only for anomaly investigation. Thus, electronic document management and digital identification serve as the foundation; e-invoicing provides reliable primary data. Big Data and AI form the analytical core, and RPA robots drive the operations, ensuring the end-to-end accuracy of tax-liability calculations and minimizing regulatory risks.

The digital loop yields practical benefits when data are cleansed before entering accounting registers, regulatory updates are applied promptly, and discrepancies are identified before the close of the reporting cycle. Automated extraction of primary documents—embedded within electronic document management—enables the instant matching of invoice and payment fields with declaration requirements. Recognition algorithms and robotic processing scenarios eliminate human-entry errors, standardizing all information. Simultaneously, the validation module checks the correctness of details, the

logical coherence between amounts and rates, and the presence of all mandatory attributes, thereby suppressing the garbage in—garbage out effect at the initial stage.

The accuracy of calculations is maintained through continuous synchronization of the normative–legal framework with corporate tax-assessment rules. Application programming interfaces between enterprise systems and tax-authority portals automatically transmit the latest parameters for rates, reliefs, and coefficients, which take effect immediately upon publication. This mechanism eliminates regulatory lags and minimizes the likelihood of applying outdated norms, transforming the legal environment into a live reference data source for calculation algorithms.

The final layer comprises deviation analysis and risk scoring. Machine-learning models compare current operational metrics with benchmark profiles, identifying anomalous transaction chains, discrepancies between the tax base and actual operations, and flagging potential risk positions even before filing deadlines. An integrated predictive analytics engine generates recommendations for adjustments. It initiates automatic or semi-automatic corrections, thereby rendering the data → verification → correction loop continuous and eliminating key errors at their point of origin rather than during subsequent audits.

Thus, the integration of digital tools—from unified digital identification and e-document management to large-scale AI-based analytical platforms and robotic automation—creates an end-to-end loop capable not only of instant error detection and correction but also of proactive adaptation to changes in the normative framework. It enables modern tax authorities and enterprises to minimize the human factor, make calculations more accurately, reduce the volume of penalty assessments, and thus change from reactive control to predictive risk management. The approach underpins further development of the digital tax ecosystem and opens new horizons for very effective and transparent interaction between taxpayers and regulators.

Conclusion. This study has shown that the digitalization of tax administration over the last few years has drastically changed the landscape of liability calculations, resulting in a 17-23 percentage-point increase in the share of electronic filings, with nearly 90% coverage of online payments. Nevertheless, the magnitude of the tax gap in the United States—estimated at $696 billion—and the late filing of 1.1 million returns in the United Kingdom underscore that significant risks of inaccuracy persist even within extensive digital infrastructures.

The analysis revealed that the end-to-end architecture of digital tools—from unified digital identification (utilized by 81–100% of individuals and approximately 90% of companies) and electronic document management (93.3% e-filing in the USA), through mandatory e-invoicing (a $15.9 billion market with a fourfold growth forecast by 2033), to Big Data analytic platforms and AI models with forecasting accuracy around 90% and RPA deployment in 53% of large enterprises—forms a unified mechanism for validating and automatically correcting data at the transaction-entry stage.

The integration of these technologies enables a shift from a reactive response to proactive tax-risk management: automatic synchronization of regulatory bases, instantaneous verification of invoice and payment fields, and an uninterrupted data verification-correction cycle minimize the influence of the human factor and reduce the likelihood of penalty assessments. Consequently, a new model of tax compliance emerges, in which transparency in taxpayer–regulator interactions is achieved through the accuracy and timeliness of calculations, thereby establishing a firm foundation for the ongoing evolution of the digital tax ecosystem.

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