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AUTOMATION AND DIGITALIZATION IN COST AUDIT: CHALLENGES AND OPPORTUNITIES

АВТОМАТИЗАЦІЯ ТА ЦИФРОВІЗАЦІЯ В АУДИТІ ВИТРАТ: ВИКЛИКИ ТА МОЖЛИВОСТІ

Summary. *Introduction.* *In the current conditions of global digital transformation, automation of cost audit processes plays a key role in improving the efficiency of financial control. The use of modern technologies, such as artificial intelligence (AI), Blockchain, and Big Data, facilitates fast and accurate analysis of financial transactions, minimizing the influence of the human factor and the possibility of fraud. Automated systems can reduce audit time, improve the quality of inspections, and ensure transparency of company expenses.*

Purpose. *The purpose of the study is to analyze the possibilities of automating cost audit, identify key challenges that arise in the process of digitalization, and provide recommendations for the effective implementation of modern technologies in the field of audit.*

Materials and Methods. *The research materials include modern scientific sources, international auditing standards, practical cases of using software for automated cost analysis, in particular, systems such as ACL, IDEA, CaseWare and SAP. Particular attention is paid to the review of modern intelligent technologies, in particular artificial intelligence and machine learning, which are increasingly being implemented in the audit and provide new opportunities for effective verification of enterprise costs. The author uses the methods of comparative analysis, synthesis, description, and theoretical generalization to formulate the areas of application of innovative tools, as well as to analyze practical examples of the use of modern digital platforms and financial instruments.*

Results. *The study confirms that the use of artificial intelligence, Blockchain, and machine learning can significantly improve the accuracy of cost*

verification and reduce the likelihood of errors. The use of big data analytics helps build detailed financial models that help forecast costs and optimize budgeting. At the same time, the results of the analysis indicate the need for a comprehensive update of internal business processes for the successful implementation of digital technologies. Automation of cost audit is an important step towards increasing the transparency of financial control and the efficiency of enterprise resource management. Successful digitalization of the audit will minimize financial risks, improve the quality of management decisions, and contribute to the development of companies' competitiveness in today's dynamic business environment.

Discussion. The discussion for automation and digitalization in cost audit are extremely broad and promising. They include both the technical improvement of audit processes and the change in the role of the auditor in the context of digital transformation. The use of modern digital technologies helps to increase audit efficiency by automating routine operations, reducing audit time and reducing the likelihood of human error. The use of artificial intelligence, big data analytics, and specialized software opens up new opportunities to identify atypical transactions, financial irregularities, and reduce fraud risks. Thanks to digital solutions, auditing is becoming a continuous monitoring process that allows for real-time cost estimation. In the long run, this will help to increase the transparency of financial information, stakeholder trust, and the overall quality of audit services.

Key words: *audit automation, digitalization, cost audit, artificial intelligence, big data analytics, cost optimization.*

Анотація. *Вступ. У сучасних умовах глобальної цифрової трансформації автоматизація процесів аудиту витрат відіграє ключову роль у підвищенні ефективності фінансового контролю. Використання сучасних технологій, таких як штучний інтелект (ШІ),Блокчейн , Big Data,*

сприяє швидкому та точному аналізу фінансових операцій, мінімізуючи вплив людського фактору та можливість шахрайства. Автоматизовані системи дозволяють скоротити час на аудит, підвищити якість перевірок і забезпечити прозорість витрат підприємства.

Мета. Метою дослідження є аналіз можливостей автоматизації аудиту витрат, виявлення ключових викликів, що виникають у процесі цифровізації, та надання рекомендацій щодо ефективного впровадження сучасних технологій у сферу аудиторської діяльності.

Матеріали і Методи. Матеріали дослідження є: сучасні наукові джерела, міжнародні стандарти аудиту, практичні кейси використання програмного забезпечення для автоматизованого аналізу витрат, зокрема таких систем, як ACL, IDEA, CaseWare та SAP. Особливу увагу приділено огляду сучасних інтелектуальних технологій, зокрема штучного інтелекту та машинного навчання, які дедалі активніше впроваджуються в аудит та забезпечують нові можливості для ефективної перевірки витрат підприємств.

Використано методи порівняльного аналізу, синтезу, опису, теоретичного узагальнення для формування напрямів застосування інноваційних інструментів, а також аналізу практичних прикладів використання сучасних цифрових платформ і фінансових інструментів.

Результати. Дослідження підтверджує, що застосування штучного інтелекту, Блокчейн, машинного навчання дозволяє значно підвищити точність перевірки витрат, зменшити ймовірність помилок. Використання аналітики великих даних сприяє побудові детальних фінансових моделей, що допомагають прогнозувати витрати та оптимізувати бюджетування. Водночас результати аналізу свідчать про необхідність комплексного оновлення внутрішніх бізнес-процесів для успішного впровадження цифрових технологій. Автоматизація аудиту витрат є важливим кроком до підвищення прозорості фінансового

контролю та ефективності управління ресурсами підприємства. Успішна цифровізація аудиту дозволить мінімізувати фінансові ризики, покращить якість управлінських рішень та сприятиме розвитку конкурентоспроможності компаній у сучасному динамічному бізнес-середовищі.

Перспективи. Перспективи автоматизації та цифровізації в аудиті витрат є надзвичайно широкими та багатообіцяльними. Вони охоплюють як технічне вдосконалення процесів аудиту, так і зміну ролі самого аудитора в умовах цифрової трансформації. Застосування сучасних цифрових технологій сприяє підвищенню ефективності аудиту за рахунок автоматизації рутинних операцій, скорочення часу перевірки та зменшення ймовірності людських помилок. Використання штучного інтелекту, аналітики великих даних та спеціалізованого програмного забезпечення відкриває нові можливості для виявлення нетипових транзакцій, фінансових порушень та зниження ризиків шахрайства. Завдяки цифровим рішенням аудит набуває рис безперервного моніторингу, що дозволяє здійснювати оцінку витрат у режимі реального часу. У перспективі це сприятиме підвищенню прозорості фінансової інформації, довіри з боку зацікавлених сторін та загальному підвищенню якості аудиторських послуг.

Ключові слова: *автоматизація аудиту, цифровізація, аудит витрат, штучний інтелект, аналітика великих даних, оптимізація витрат.*

Problem formulation. The problem statement in this study is the need to adapt the traditional approach to cost audit to the conditions of the modern digital environment. Given the rapid development of information technology and the growth of financial information, traditional audit methods are losing their effectiveness, as they are not always able to ensure efficiency, accuracy and completeness of the audit. The increasing complexity of business processes, the

need to analyze large amounts of data, and the growing requirements for transparency and reliability of financial information necessitate the introduction of automated and digital solutions in the audit of expenses. The selection and effective use of digital tools, insufficient training of specialists to work in the new environment, as well as risks associated with cybersecurity and the quality of automated analysis remain problematic. That is why there is a need for a comprehensive study of the challenges and opportunities that accompany the digital transformation of cost audit.

Analysis of recent research and publications. A significant contribution to the development of this topic was made by such researchers as Nazarova K.O., Mysiuk V.O., Kopotienko T.Y., Bezverkhyi K.V., Paskalova A.G., Shutko T.I., Ostapenko T.M. and Pivniuk O.P., Holovatska S.I. In their works, they highlight approaches to cost control and efficiency of their use. In the context of performance audit, the International Standards on Auditing, as well as the works of foreign experts, in particular A. Ahrens, J. Lobbeck and others, play a significant role. However, despite the existence of theoretical developments, the current state of research shows insufficient development of practical aspects of implementing digital solutions in the field of financial cost control. The issue of creating a unified methodology for automated control, as well as the formation of a systematic approach to the state regulation of this process, remains open, which limits the possibilities of digital audit as a tool for managing the costs of enterprises.

The purpose of this study is to analyze the possibilities of automating cost audit, identify the key challenges arising in the process of digitalization, and provide recommendations for the effective implementation of modern technologies in the field of audit activities.

Materials and Methods. The research materials include: modern scientific sources, international auditing standards, practical cases of using software for automated cost analysis, in particular, systems such as ACL, IDEA, CaseWare

and SAP. Particular attention is paid to the review of modern intelligent technologies, in particular artificial intelligence and machine learning, which are increasingly being implemented in the audit and provide new opportunities for effective verification of enterprise costs.

The author uses the methods of comparative analysis, synthesis, description, and theoretical generalization to formulate the areas of application of innovative tools, as well as to analyze practical examples of the use of modern digital platforms and financial instruments.

Presentation of the main material. One of the key tools of modern audit is the digitalization of the processes involved. In general, digitalization involves the use of advanced digital technologies to automate and improve the efficiency of various aspects of activities. Audit automation is a term that describes the use of cloud computing and database software to automate audit tasks such as data entry and analysis. Automated workflows significantly reduce the time and effort required to complete workflows [1]. Types of audit automation include a variety of technologies ranging from data integration and visualization to complex algorithms that mimic human cognitive functions. Figure 1 presents a generalized classification of the main approaches to audit digitalization used to optimize financial control and reduce costs.

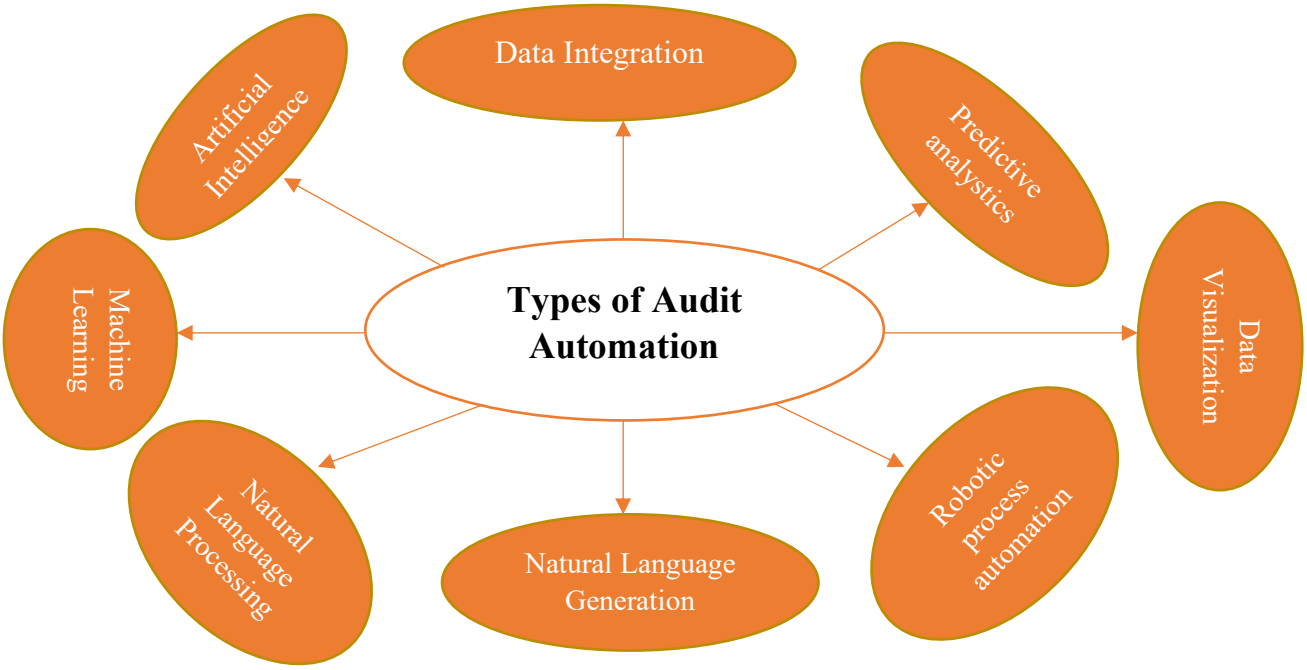

Fig. 1. Types of Audit Automation

Source: built on the basis of [1]

Each type of automation performs certain functions aimed at optimizing the analysis, risk assessment, and data processing processes. Data integration provides a consistent information base by combining data from different sources for further analysis. Predictive analytics uses mathematical models to assess risks and predict possible deviations, such as compliance analysis. Data visualization helps to present the results of the analysis in the form of graphs, dashboards (GRC), and other tools for better understanding. Robotic Process Automation (RPA) is an advanced technology that uses software robots (or bots) to automate repetitive, rule-based tasks and performs best with structured data or information that matches a predefined data model [2]. Natural language generation automatically generates text-based analytical reports and conclusions based on structured financial data. Natural Language Processing (NLP) - analyzes unstructured financial information, allowing auditors to get quick answers to queries. Machine learning improves risk and fraud detection algorithms by analyzing historical data and adapting to new trends. And artificial intelligence

(AI) performs complex audit tasks such as anomaly recognition, analysis of financial documents, and automatic discrepancy detection. Automation of audit processes provides a significant increase in the efficiency, accuracy, and transparency of financial control. Table 1 shows the key benefits of audit automation and their impact on processes.

Table 1

Benefits of audit automation

EFFICIENCY	Audit automation significantly reduces the time required to collect and analyze data. Tasks that used to require hours of manual labor can be completed instantly with the click of a button. Bots help to systematize data and generate reports automatically.
ACCURACY	The use of automated systems minimizes the risk of human errors in the collection and processing of information. Data consistency is improved, which ensures more accurate and reliable inspection results.
COST SAVINGS	Automation significantly reduces labor costs as manual operations are reduced. It also reduces the likelihood of financial losses due to undetected errors or fraud.
CONSISTENCY	Automated systems perform audits according to clearly defined algorithms, which ensures the stability and repeatability of processes. Standardized procedures simplify audits and increase compliance.
RISK MANAGEMENT	Automated systems detect violations, deviations, and potential threats faster, allowing you to respond in a timely manner and minimize risks before they become serious problems.

Source: built on the basis of [1]

Automation can be integrated into every stage of the audit process, which can significantly improve audit efficiency and accuracy. Starting with risk assessment, automation uses analytical methods and dashboards to quickly assess compliance risk, visualize risks, analyze flows, and monitor business activities. This helps ensure accurate and timely risk assessment for more efficient audit planning. At the audit planning stage, automation helps to process a large volume of text documents, as well as perform exploratory and "what if" analysis. This allows auditors to focus on decision-making, reducing time spent on routine tasks. Evaluating the effectiveness of audit design also benefits from automation,

particularly through the ability to model data, automate internal audit tasks, and batch reporting. This increases the accuracy and speed of the analysis. At the fieldwork stage, automation ensures effective population testing, data integration, and the detection of suspicious IT system logs. The use of analytics, robotic automation, and natural language processing enables auditors to collect and process data faster, reducing the risk of errors and simplifying control effectiveness testing. During the reporting phase, automation allows you to generate text reports automatically, provides data visualization, and allows you to quantify the impact of various factors on the audit result. This reduces the time required to create reports and increases their accuracy. The final step related to issue tracking and continuous monitoring, this phase of the process builds on the issue tracking history to gain insights through trend analysis and key performance indicators (KPIs). It can also establish a continuous audit model.

One of the main advantages of digital technologies is the ability to automate business processes. According to McKinsey, in 2022, automation could reduce operating costs by up to 40%, and optimization of routine tasks contributed to a more efficient allocation of resources to strategic areas [3].

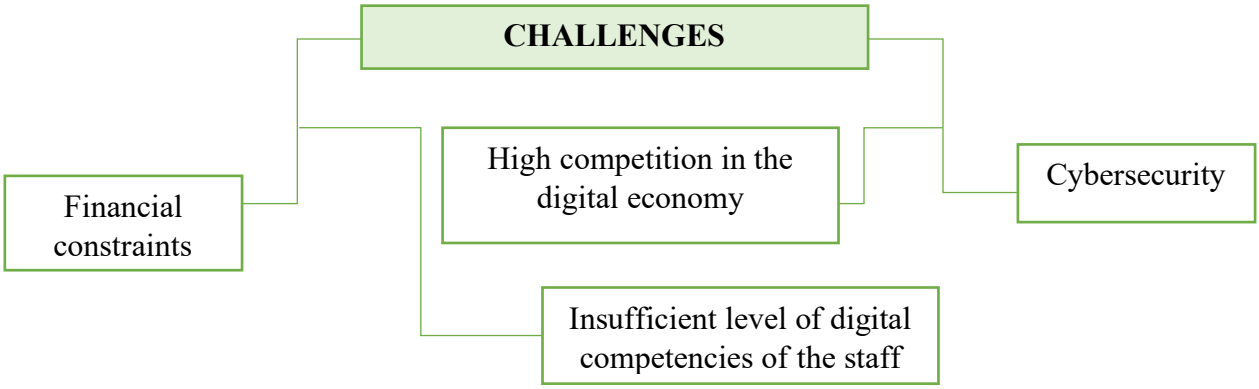

Fig. 2. Challenges in the process of digital transformation

Source: built on the basis of [4; 5]

The main challenge to the adoption of digital solutions is financial constraints, especially for small businesses that have limited capacity to invest in innovation. Micro, small, and medium-sized enterprises (MSMEs) are the backbone of

Ukraine's economy, accounting for 99.98 percent of all businesses, providing 74 percent of all jobs, and generating 64 percent of value added. Prior to the full-scale invasion, 59.7 percent of companies considered their financial and economic condition to be good, while 18 percent assessed their company's condition as excellent. However, only less than 20 percent of small businesses have sufficient funding to implement digital technologies. Currently, almost one-third of small and medium-sized enterprises (30.2 percent) in Ukraine consider their financial and economic condition to be poor, while another 47.9 percent assess their condition as satisfactory [4]. At the same time, experts emphasize that even with a limited budget, businesses can start digital transformation using affordable solutions, including cloud services and free business process automation software. Another significant obstacle to digital transformation is the lack of digital skills among employees. Employees of small businesses often do not have the necessary competencies to effectively use modern technologies, which complicates the process of implementing new systems and reduces their productivity. At the same time, companies that regularly invest in staff training demonstrate greater adaptability to digital change and are able to use technology more effectively to achieve business goals. Another critical challenge is ensuring cybersecurity. The expansion of digital solutions inevitably leads to an increase in cyber threats. According to Cybersecurity Ventures, in 2023, global losses from cybercrime grew by 15-20% annually, which poses a serious risk to small businesses that often do not have sufficient resources to protect their data [5]. In Ukraine, numerous cyberattacks on the business environment have already been recorded, which confirms the importance of investing in cybersecurity to ensure data security and build customer confidence.

Thus, digital transformation is a key factor in the development of small businesses, but its implementation requires significant financial, human, and technical resources. In order to successfully adapt to the digital economy, small businesses should develop step-by-step digitalization strategies, starting with

affordable and effective tools such as cloud services and business process automation. Investing in staff training, enhancing cybersecurity, and regularly monitoring technological changes will not only reduce risks but also significantly increase the competitiveness of businesses in the digital age.

Digital technologies are fundamentally transforming the business models of small businesses, providing them with new opportunities to operate effectively in the face of fierce competition and dynamic change. They are becoming a key tool for adapting to the requirements of the modern market. Thanks to digitalization, businesses can not only reduce costs and increase operational efficiency, but also open up new formats of interaction with clients, partners, suppliers and even competitors. In the audit industry, technologies such as RPA (Robotic Process Automation), AI (Artificial Intelligence), Big Data (Big Data Analytics), and Blockchain are used. Details of the purpose and capabilities of these technologies for optimizing audit activities are shown in Table 2.

Table 2

	Assignment	*Opportunities*
RPA	• Collecting financial information from various systems (ERP, CRM, accounting programs). • Checking the consistency of data between different sources • Automated transaction analysis to identify suspicious transactions. • Checking compliance with accounting standards and tax legislation. • Analysis of financial statements and search for deviations. • Generation of reports and documentation	1. Reduced time spent on routine tasks. 2. Reducing the human factor and the likelihood of errors. 3. Improving the quality of audits. 4. Optimization of audit costs. 5. Ability to analyze large amounts of data in real time.
AI	• Big data processing and analysis • Automation of routine processes • Risk assessment, financial market forecasting, fraud detection.	1. Fast and accurate processing of information. 2. Automation of accounting 3. Detection of errors. 4. Detection of cyber threats
Big Data	• Real-time analysis of financial transactions.	1. Reduce time spent analyzing large amounts of data.

	• Automated analysis of large amounts of accounting data. • Identification of non-standard transactions • Using historical data to predict financial risks. • Assessment of future trends in the financial sector.	2. Increase the accuracy of audits. 3. Detection of financial irregularities and fraud at early stages.
Blockchain	• Saving transactions • Access to reliable financial records in real time • Automation of checks with smart contracts • Optimization of the reporting process	1. Increase transparency and trust in financial data. 2. Minimizing the risk of manipulation and errors in reporting. 3. Reducing audit costs 4. Improving the effectiveness of regulatory control.

Source: built on the basis of [6; 7]

The use of technologies such as Big Data and Blockchain in the audit industry significantly increases the efficiency and accuracy of audits, making processes transparent and automated. Big Data allows you to process huge amounts of data, detect anomalies and fraud, and provides a quick risk assessment. Blockchain ensures data immutability and transparency, which reduces the risk of manipulation and increases confidence in financial statements. Both of these technologies not only increase the accuracy of audits and reduce audit costs, but also facilitate rapid response to changes in the market environment. At the same time, their integration into audit practices opens up new opportunities for more effective risk management and regulatory compliance.

Conclusions and prospects for further research. Based on the study, the following conclusions and generalizations were made: New technologies have a significant potential to improve the daily activities of auditors, as they allow for increased efficiency and effectiveness. The use of process automation software will help auditors to reduce their workload by automating repetitive and structured tasks, which will allow them to focus on more strategic aspects of their work. Also, new technologies will affect the skills requirements of auditors, as mastering advanced tools requires additional technical knowledge. In addition,

data analysis skills will become more and more in demand in audit firms. This may result in the need to hire new types of professionals who can effectively respond to technological changes and innovations in audit practice. The use of process automation software such as RPA (Robotic Process Automation) can help auditors reduce their workload by automating repetitive and structured tasks such as data processing, transaction review, and reporting. Intelligent systems tools, such as Big Data and AI (artificial intelligence), will provide auditors with the ability to conduct more detailed analysis of large amounts of data, detect anomalies, predict risks and automatically detect fraud. In view of these aspects, future research could continue to analyze the impact of modern technologies on audit firms from different perspectives, which would allow for a broader understanding of these changes and provide an opportunity to complement and clarify the findings of this study.

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