Valentyna Panasyuk iD https://orcid.org/0000-0002-5133-6431

Doctor of Economics Sciences, Head of the Department of Audit, West Ukrainian National University,
e-mail: tina.panasjuk@gmail.com

CLOUD TECHNOLOGIES AND BLOCKCHAIN IN AUDITING: A NEW STAGE IN THE DEVELOPMENT OF CONTROL SYSTEMS

ABSTRACT

The purpose of the article is to study the impact of cloud technologies and blockchain on the development of control systems in auditing, in particular on the effectiveness of internal control procedures and information transparency. The central hypothesis is that the integration of modern digital technologies into accounting and audit processes can significantly increase the transparency of financial transactions, reduce information asymmetry and improve the effectiveness of risk management and internal control procedures. The study is a response to the growing challenges faced by traditional auditing in a dynamic business environment.

Methodology. The methodological approach of the study is theoretical, based on a comprehensive analysis and synthesis of modern scientific literature. The study draws on general scientific methods, including bibliometric analysis, synthesis and systems-structural approaches, to explore the potential of cloud computing and blockchain technologies as tools for increasing financial transparency and control. The study findings were enriched by a multidimensional view of how these technological practices can be shaped by real-world constraints and organizational readiness.

Results of the research. The analysis confirmed that the integration of cloud technologies and blockchain fundamentally transforms auditing into a continuous and proactive process. Key findings demonstrate that these technologies provide unique advantages, such as increased scalability, immutability and transparency, which are crucial for combating fraud and financial crimes. At the same time, the study also identified significant challenges, including cybersecurity threats, dependence on network infrastructure, integration complexity and regulatory uncertainty. The results offer a new perspective on how technology solutions can be applied to improve financial control systems and improve corporate governance.

Keywords: cloud computing, blockchain, audit, internal control systems, digital transformation, transparency, digital tools, digitalization

JEL Class: M42, O33

Introduction

The ongoing digital transformation of economies presents both new challenges and opportunities for guaranteeing the transparency, efficiency, and reliability of financial reporting and internal control systems within organizations. Conventional auditing techniques, despite decades of use, often fail to address the complexity of modern business, fraud risks, and the demand for operational verification of financial transactions. The increasing volume of data, the integration of global financial markets, and the spread of remote work put new demands on internal control and audit systems, compelling organizations to seek more effective technological solutions.

Cloud technologies and blockchain provide unique opportunities for modernizing audit and control, ensuring process automation, secure data storage, increasing transparency and efficiency of control systems. The integration of these technologies allows combining various sources of information, optimizing audit procedures and increasing the ability of organizations to quickly adapt to a changing business environment (Appelbaum & Nehmer, 2019; Banerjee et al., 2024).

At the same time, the implementation of digital solutions in audit practices is accompanied by certain challenges. These include cybersecurity threats, the need to comply with regulatory requirements, as well as the need for highly skilled professionals who can effectively manage complex technological audit systems (Wylde et al., 2022; Punia et al., 2024). In addition, organizations have to balance transparency with the protection of confidential information, which is critical to ensuring trust in financial reporting and management decisions.

The purpose of this study is to examine the impact of cloud technologies and blockchain on the development of control systems in auditing, in particular on the effectiveness of internal control procedures and information transparency. The following research hypotheses have been formulated:

1. The introduction of cloud technologies and blockchain into the practical activities of accountants and auditors has a positive effect on their work efficiency, and also has a favorable economic effect on the enterprise.
2. The existing regulatory framework in Ukraine regarding the use of cloud technologies and blockchain in accounting and auditing is fragmentary and needs to be improved.
3. The integration of cloud technologies and blockchain into auditing practice fundamentally transforms auditing from a retrospective process into a proactive and continuous one.

Literature review

Recent academic studies have validated that the digital transformation of accounting and auditing is fundamentally altering control methodologies and enhancing the effectiveness of managerial and financial decisions. The latest research, in particular, focuses on three key areas: integrating cloud technologies, using blockchain, and combining digital tools to automate audit processes.

Cloud technologies are seen as a means of increasing the efficiency and scalability of audit procedures (Moghadasi et al., 2018). They allow for centralized data management, reduce information processing time, and increase the accessibility of financial reporting for auditors and management (Laposha, 2022). In the public sector, the use of digital technologies contributes to increased transparency and efficiency of financial control, which reduces the risks of fraud and errors (Fedenko et al., 2024).

Blockchain is seen as an innovative technology that ensures transparency and reliability of records (Abdullahi & Safiyanu, 2023). It allows for the creation of immutable records, reducing the risk of errors and fraud. The use of closed blockchains provides increased security and control over data access (Liu et al., 2019). Integrating blockchain into internal financial reporting control systems allows for the automation of verification processes and reduces the likelihood of fraudulent manipulation (Adekunle et al., 2024).

Combining blockchain with cloud platforms creates dynamic environments for collaborative auditing and real-time data management, which improves audit quality and prompt risk detection (Sheela et al., 2023; Sheikh et al., 2024).

The combined use of digital tools, including big data analytics and artificial intelligence, allows for the automation of routine management accounting tasks and the focus on the analysis of critical information (Korhonen et al., 2021; Han et al., 2023). This creates a single, reliable information base for all stakeholders and reduces information asymmetry (Islam Priom et al., 2024). At the same time, the use of digital technologies is accompanied by challenges in the field of security and privacy (Wylde et al., 2022; Punia et al., 2024). To ensure the reliability of data control, integrity audit methods are used in encrypted cloud environments, which minimizes the risks of information loss (Song et al., 2021).

The digitalization of accounting and auditing in Ukraine is also actively implemented in internal control systems (Fedenko et al., 2024; Kononenko et al., 2025). Scientists note the need to improve the regulatory framework and train qualified specialists to work with digital technologies. Digitalization also contributes

to the development of sustainable business, monitoring compliance with standards, and optimizing management decisions (Antonini, 2024; Semaniuk & Melnyk, 2022).

Thus, a review of modern literature demonstrates that the integration of cloud technologies, blockchain, and combined digital tools into accounting and auditing contributes to increasing the transparency, efficiency, and reliability of control systems. At the same time, there are challenges related to cybersecurity, regulatory compliance, and staff training, which require a comprehensive approach to implementing digital solutions in audit practice.

Research methodology

Reviewed scientific articles and professional publications issued in the period 2018–2025 were selected for the study, related to the application of cloud technologies and blockchain in auditing. The main search databases were Web of Science, Scopus, Google Scholar, as well as specialized industry journals and conference proceedings. The selection was carried out using the keywords "cloud computing", "blockchain", "audit", "internal control". Attention was paid to both theoretical developments and practical cases, as well as regulatory and legal documents of Ukraine and international auditing standards that regulate the procedure for conducting audits and organizing internal control procedures.

The analysis of the selected materials was conducted according to the following criteria: technological characteristics, impact on internal control and audit efficiency, data transparency and security, economic efficiency, as well as organizational and regulatory aspects of implementation. Repetitive mechanisms, such as record immutability, transparency, automated auditing, and compliance with standards, were systematized and compared across sources. This allowed us to identify the key trends and limitations in the application of cloud technologies and blockchain in audit practice.

Based on the synthesis of theoretical sources, regulatory documents, and practical cases, conclusions were drawn regarding the classification of technologies, their compliance with audit standards, the effectiveness of internal control, and the formulation of recommendations for organizations. Methodological limitations include publication bias, different interpretations of terms in sources in different languages, and rapid changes in the regulatory framework in the field of audit digitalization.

Benefits and challenges of using cloud technologies in auditing

In the context of auditing, as Moghadasi et al. (2018) have noted, cloud technology represents a form of IT outsourcing that allows organizations to use computing resources remotely over the internet. This approach fundamentally alters auditing because the audited data and systems are no longer under the physical control of the organization.

Cloud technology is defined by several key features:
1) ondemand selfservice: users can access resources at their convenience without any direct interaction with the provider;
2) broad network access: services are available over the internet and can be used from various devices;
3) resource pooling: the provider's resources are pooled to serve multiple customers in a multitenancy model;
4) rapid elasticity: resources can be quickly scaled (increased or decreased) to match user needs.

The use of cloud technologies in auditing brings notable benefits that enhance the effectiveness and dependability of inspections. The key advantage is scalability and flexibility, which allows auditors to work with large volumes of data without the need to invest in their own physical infrastructure. This approach provides operational access to the computing power necessary for information analysis. In addition, cloud platforms support the automation of routine processes, which, according to Vasyliuk et al. (2025), minimizes the impact of the human factor and increases the reliability of internal control systems.

One of the most significant advantages is the integration with blockchain technologies. There are different approaches to the application of blockchain in auditing in the literature:

- private blockchains provide access control, protection of confidential data, and high transaction speed, but are less transparent to external parties (Liu et al., 2019);
- public blockchains guarantee full transparency and availability, but can be slower and more difficult to scale in a corporate environment (Adekunle et al., 2024).

Balancing these approaches, modern audit practices often choose hybrid solutions that combine the security of private networks with the transparency of public ledgers. Thanks to this combination, an immutable distributed register containing all financial transactions is created. This, according to Gomaa et al. (2022), solves the problem of data reconciliation between different parties, since there is a "single truth" (single-ledger). Thus, blockchain frameworks, as Assiri and Humayun (2023) point out, can automate auditing, ensuring transparency and immutability of records. These changes define a new stage in the development of audit systems, where technology becomes not only a data collection tool, but also a key factor in increasing the reliability and effectiveness of internal control.

Despite these advantages, the implementation of cloud solutions in auditing faces serious challenges. One of the main ones is data security. Storing confidential information on remote servers increases the risks of unauthorized access and data leakage. To address this problem, researchers are developing advanced public audit schemes for cloud storage that use identification protocols to improve the security and accuracy of audits (Wang et al., 2024).

Another significant challenge is the reliance on a strong network connection. As Bataiev et al. (2025) note, the effectiveness of cloud-based systems is directly tied to the stability and bandwidth of the network, which creates issues in regions with limited infrastructure. This can cause delays that are critical for real-time auditing. To overcome this problem, Yi et al. (2022) propose the use of edge-computing, which allows to reduce delays and increase the efficiency of audits in distributed systems. Also, technical challenges include the complexity of migrating legacy audit systems to the cloud environment, which requires significant efforts and investments. Overcoming these challenges requires a systemic approach and the implementation of new architectures.

Table 1. *Benefits and challenges of using cloud technologies in auditing*

Category	Benefits	Challenges
Technical	Scalability and flexibility for handling large data volumes.	Data security and risks of unauthorized access.
	Integration with blockchain for immutability and transaction transparency.	Complexity of integration with legacy accounting systems.
	Automation of routine processes via cloud platforms.	Dependence on network infrastructure and potential delays.
Organizational	Lower costs for in-house IT infrastructure.	Need for staff training and business process adaptation.
	Operational access to resources from any location.	Legal and regulatory uncertainty regarding data storage.

Source: Own study based on: Bataiev et al. (2025); Wang et al. (2024); Assiri and Humayun (2023).

In our opinion, the main problem hindering the introduction of cloud technologies into Ukrainian accounting and auditing is legislative uncertainty. The current regulatory framework does not contain special provisions that would regulate the use of remote digital environments, which creates significant legal risks for enterprises.

The Law of Ukraine «On Accounting and Financial Reporting in Ukraine" No. 996-XIV (Law No. 996-XIV) defines only general requirements for accounting, document storage and reporting forms. It does not contain any provisions on the admissibility or regulation of the use of cloud services as the main technical environment for recording and archiving accounting information.

Despite the existence of the Law of Ukraine "On Electronic Commerce" No. 675-VIII (Law No. 675-VIII) and the Law of Ukraine "On Electronic Trust Services" No. 2155-VIII (Law No. 2155-VIII), difficulties arise in practice. Not all cloud systems are compatible with a qualified electronic signature (QES), which complicates the granting of legal force to documents and forces enterprises to duplicate the storage of digital documents.

In Ukraine, there is no mandatory certification of cloud accounting systems for compliance with international standards, in particular ISO/IEC 27001:2013. This gap leaves unresolved risks of data loss, unauthorized access and falsification.

When using foreign cloud platforms, such as Google Cloud or Amazon Web Services, there is a potential conflict with the Law of Ukraine "On Personal Data Protection" No. 2297-VI (Law No. 2297-VI). This is due to the fact that not all foreign providers guarantee the localization of financial data in Ukraine or its compliance with national requirements, which creates risks for information confidentiality.

The tax administration system, which is regulated by the Tax Code of Ukraine and the Order of the Ministry of Finance No. 987 dated 31.12.2022, is often incompatible with the technical capabilities of cloud platforms. Many cloud services do not have built-in modules for exporting reporting in the formats required by the State Tax Service.

Among the positive legislative steps of Ukraine that create conditions for the implementation of blockchain and cloud technologies in practice, it is worth noting the Law of Ukraine "On Cloud Services" (Law No. 2075-IX), which audits the legal framework for the provision and use of cloud services, and also introduces the first cloud principle for the public sector. In addition, Resolution of the Cabinet of Ministers No. 154 of 2025 regulates the activities of cloud providers and provides for the possibility of their official registration for work with state bodies, which paves the way for the integration of cloud technologies into the sphere of financial control and audit.

An important step towards the digitalization of financial processes is also the Law of Ukraine "On Virtual Assets" No. 2074-IX (Law No. 2074-IX), which creates a regulatory framework for the use of blockchain technologies in the storage and processing of financial data. In combination with existing laws on electronic document management and electronic trust services, these acts form a legal basis for the dissemination of innovative technologies in the audit system, ensuring transparency, reliability and increasing trust in financial reporting.

Thus, the lack of special regulations for storing accounting information in the cloud, problems with the compatibility of electronic signatures, unclear regulation of data protection when using foreign providers, and the lack of mandatory certification of cloud platforms are key challenges. Overcoming these problems requires not only technical adaptation, but also harmonization of legislation, which will ensure the proper level of information security and legal reliability of data required for auditing in a modern digital environment.

Characteristics of blockchain in the audit system

Blockchain is a distributed ledger technology that provides immutability, transparency, and decentralization of data (Liu et al., 2019). These properties make it an ideal tool for strengthening internal control systems in organizations, as it creates an immutable chain of transactions that is accessible to all network participants. In today's economy, where existing centralized control systems are vulnerable to manipulation and fraud, blockchain offers a new, more reliable solution (Adekunle et al., 2024).

It allows you to track all financial transactions in real time, which significantly reduces the risks of corruption and fraud. Because each record in the chain is immutable, it is impossible to secretly alter or delete

transaction information. This creates a reliable digital trail that auditors can use to quickly verify data integrity. This in turn increases trust in financial reporting and strengthens internal controls.

Focusing on access rights and transaction verification permissions, blockchain technology can be configured in different ways to grant different users different access rights, as well as the rights to write, update, and verify transaction records. Typically, public and private blockchains differ in the scale of the network (i.e., the number of nodes involved), permissions to join the network, and the approach to transaction verification, suggesting that control, ownership, confidentiality, and access describe the dominant key design decisions that help organizations understand which type of blockchain best suits their needs (Han et al., 2023).

Scientists include transparency, immutability, security, and decentralization as the main characteristics of blockchain (Figure 1).

Figure 1. *Main characteristics of blockchain*
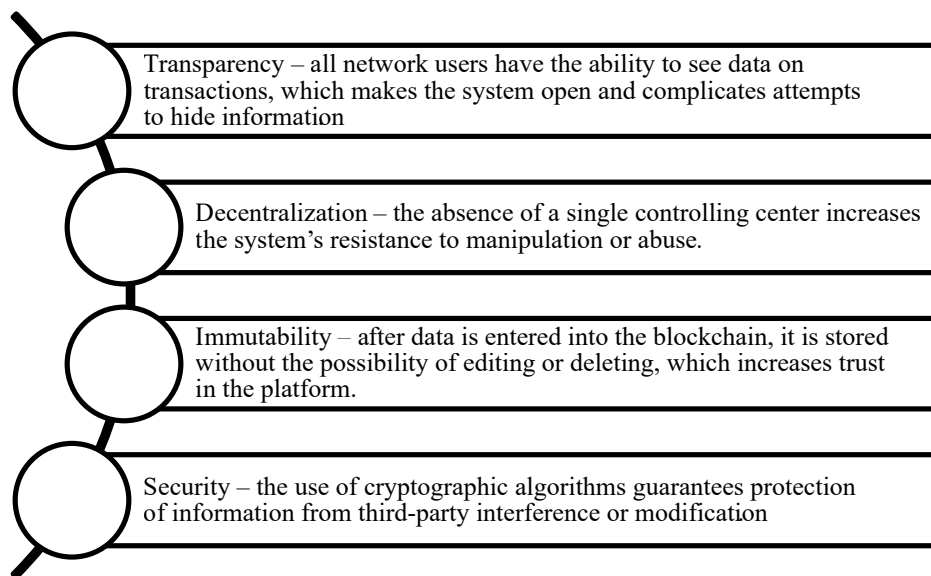
Source: Own study based on: Vasyliuk et al., 2025.

The use of cloud and blockchain technologies enables collaborative auditing, a process where multiple parties – including internal and external auditors and the client – work together on a shared technological platform.

Instead of performing audits sequentially and manually exchanging documents, collaborative auditing allows all participants to access data simultaneously. Cloud technologies and blockchain establish a single, trustworthy source of information. This ensures transparency, as every auditor's action and every transaction are recorded and available for review by all parties. This significantly boosts efficiency by reducing the time spent on data reconciliation and information exchange.

For instance, in the dynamic framework proposed by Sheikh et al. (2024), blockchain serves as a common register. This enables different auditors to examine data simultaneously, ensuring everyone is working with identical, unchangeable records. This removes the requirement for traditional and often time-consuming verification procedures by relying on technological trust rather than human factors alone.

Practical possibilities for use in conducting an audit

Modern audit firms and IT departments are actively implementing specialized software based on cloud technologies to optimize audit processes. These solutions not only automate routine tasks, but also provide the opportunity for continuous monitoring and in-depth data analysis.

Table 2 lists possible software products and their applications in auditing, taking into account current research in this area.

Table 2. *Cloud and Blockchain Solutions for Auditing*

Software / Technology	Audit Application Capabilities
SAP S/4HANA Cloud, Oracle ERP Cloud	Centralizing all business processes in a cloud environment simplifies data collection for audits. This allows auditors to focus on strategic analysis rather than routine data verification.
Apache Spark on AWS/ Google Cloud AI	They enable the processing of massive financial data arrays to detect anomalies and patterns that may indicate fraud. This facilitates a shift towards predictive auditing.
Blockchain Frameworks (e.g., Hyperledger, Ethereum)	Using blockchain as a foundation for auditing allows for the creation of immutable transaction logs, which eliminates the need for data reconciliation. This is the basis for the „single truth" concept in accounting.
Public Audit Systems (e.g., Cumulus)	Using blockchain as a foundation for auditing allows for the creation of immutable transaction logs, which eliminates the need for data reconciliation. This is the basis for the „single truth" concept in accounting.
Edge-Computing	Specialized blockchain-based platforms enable auditing of data stored in the cloud while guaranteeing its confidentiality and integrity. This addresses the problem of trust in cloud storage.
Audit Automation Tools	Specialized cloud-based tools can automatically collect, reconcile, and analyze data, allowing auditors to focus on complex issues. This is key to increasing efficiency.

Source: Own work.

Blockchain is currently becoming increasingly popular in auditing. Leading firms such as Deloitte and PwC from the Big Four are already actively integrating this technology into their accounting practices (Nezhyva et al., 2021).

In the field of auditing, Redchenko (2018) proposes two key directions for the development of blockchain technology. The first one is to apply this technology directly within accounting systems to guarantee the reliability of financial reporting and to perform client-approved procedures. The second direction involves offering audit services to companies that have already implemented blockchain in their own operations.

According to the Global Entrepreneurship Monitor survey conducted in 2024/2025, 27.7% of Ukrainian companies use cloud technologies in their operations, while among newly created enterprises this figure is 18.6% (GEM, 2025). This is to indicate that, although cloud solutions remain increasingly popular, their implementation is still not widespread, especially in the initial stages of business development. In particular, according to forecasts by the research company 6Wresearch, the volume of the public cloud market in Ukraine should grow by 18.86% by 2029 (Rai, 2025).

The use of cloud technologies and blockchain in audit practice directly depends on the level of implementation of these technologies in institutions and enterprises subject to audit. The higher the level of digitalization of clients, the greater the opportunities for the application of modern audit tools.

According to the research of Rudan and Pysmenny (2025), the implementation of cloud technologies in local governments demonstrates both significant potential and certain challenges. The study shows that 36.3% of surveyed local governments no longer accept cloud technologies, and another 27.4% express interest in their implementation, which worsens the spread of popularity of these solutions. However, 34.8% of respondents still do not offer cloud services, and 1.5% do not plan to implement them at all. This indicates the presence of serious obstacles, such as limited funding, lack of qualified personnel, and outdated IT infrastructure (Table 3).

Table 3. *Use and assessment of the impact of cloud technologies in local governments of Ukraine*

Category	Use of cloud technologies	Assessing the impact of cloud technologies
Use of these technologies / Significant efficiency improvement	36,30%	36,30%
Interested in implementation / Partial improvement	27,40%	46,90%
Do not use / No impact	34,80%	9,30%
Do not plan to use / Possible negative consequences	1,50%	7,50%

Source: Own study based on: Rudan and Pysmenny (2025).

The survey results show that cloud technologies are perceived mostly positively due to their ability to increase work efficiency. Thus, 46.9% of survey participants noted a partial improvement, and 36.3% - a significant increase in efficiency. Only 9.3% saw no impact, while 7.5% indicated the possibility of negative consequences. This data emphasizes that, given the existing barriers, most users consider cloud services to be an effective tool for optimizing work processes.

The results of the study by Prasad et al. (2025) prove that the implementation of blockchain technology in auditing creates a noticeable economic effect, in particular by reducing costs and increasing the efficiency of work processes. A survey of 120 auditors showed that the use of blockchain made it possible to reduce the duration of audits by an average of 25%, and operating costs by 20%. This became possible due to automated verification of transactions in real time, reducing the need for re-verification of data and optimizing document flow. In addition to direct savings, blockchain contributes to a more rational use of labor resources, reduces the burden on auditors and increases labor productivity. Thanks to constant access to reliable data, auditing is transformed from a periodic process into a continuous monitoring of financial statements, which minimizes the number of errors and reduces the need for re-verification. As a result, enterprises receive more accurate and faster analytical information, and auditors can focus on strategic aspects of control.

A separate area of economic effect is the reduction of losses from fraudulent actions. The blockchain system, due to its transparency and immutability of records, allows for faster identification of suspicious transactions. According to the results of the study, 65% of the surveyed auditors noted a decrease in the number of financial violations after the implementation of the technology. Thus, blockchain not only optimizes costs, but also increases the level of confidence in audit conclusions, providing a comprehensive economic effect – from reducing inspection time to reducing financial risks and strengthening the reputational stability of companies.

In his study, Semenenko (2024) emphasizes that the implementation of cloud technologies is a powerful factor in increasing the efficiency of companies. By moving from capital investments in physical IT infrastructure to operating expenses under a subscription model, the company maintains financial flexibility and reduces the risks of overspending. The author proves that cloud solutions cannot optimize costs for equipment, maintenance and energy consumption, while ensuring the scalability of resources in accordance with business needs. Thus, the use of cloud technologies contributes to the sustainable development of companies, ensures their competitiveness and allows for more efficient management of financial resources.

Modern auditing has reached a critical turning point, as traditional methods no longer meet the needs of a dynamic digital economy. Historically, auditing has been a backward-looking process, based on analyzing selective data from past periods. This approach is labor-intensive, prone to human error, and often fails to uncover complex fraud schemes in real time. Blockchain alters the role of the auditor from a "detective" who searches for past errors to a "trust architect" who designs systems to prevent problems. This allows auditing to become proactive and continuous, rather than a periodic check. Thanks to the immutability and transparency of a distributed ledger, auditors gain direct access to the full history of transactions, which eliminates the need for manual reconciliation and cross-checking of data.

This technological synergy not only increases efficiency, but also transforms the very foundations of auditing. It affects all key practices, from evidence gathering to financial reporting. Table 4 details how blockchain impacts traditional auditing approaches, creating a new, more reliable paradigm.

Table 4. *Transformation of auditing practice under the influence of blockchain*

Auditing practice	Traditional approach	Blockchain's impact (new paradigm)
Evidence gathering	Selective document analysis. Labor-intensive, prone to errors	Whole-population analysis: direct access to the complete transaction history in real time, eliminating the need for sampling
Transaction validation and verification	Manual reconciliation and cross-checking of data	Automated verification: transactions are validated by the network community. The auditor verifies not the data itself, but the validation process
Compliance evaluation	Checking samples for compliance with regulations after operations are completed	Embedded control: compliance with standards and laws is built into smart contracts. Violations are detected instantly
Transaction reconciliation	A lengthy process of data reconciliation between various parties	Instant reconciliation: thanks to the ‚single source of truth' (single-ledger), reconciliation becomes unnecessary, which significantly increases efficiency
Financial reporting	Reporting for a specific period (month, quarter, year)	Real-time reporting: data is continuously updated, allowing reports to be generated at any moment
Planning and advising	Based on historical data	Forecasting and strategy: complete and accurate records allow for quick identification of problem areas, prioritization of plans, and finding long-term patterns
Decision support	Conclusions are based on verified data from past periods	Proactive control: providing reliable information for analytics and forecasting the consequences of actions

Source: Own study based on: Liu et al., 2019; Shu et al., 2021.

The process of implementing blockchain in auditing

Implementing blockchain into audit practice is not just a technical project, but a strategic investment in the company's future. We propose to use a structured, phased approach, which, in our opinion, will allow for the effective and minimal risk integration of this technology into existing control systems (Figure 2).

Figure 2. *Stages of implementing blockchain in auditing*
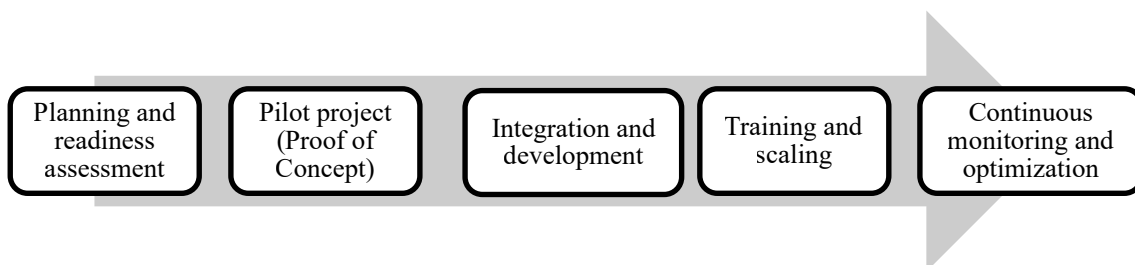
Source: Own work.

1. Planning and Readiness Assessment. A thorough review of the existing audit framework, including identifying problem areas and assessing the required resources (financial, human, and technical) for implementation. At this stage, the project strategy and objectives are defined.

2. Pilot Project (Proof of Concept). Launching the project in a limited area to test the technology under real conditions. This step allows for the identification of potential issues early on and demonstrates the blockchain's value without risk to the entire company.

3. Integration and Development. The technical development and integration of the blockchain solution with current systems. During this phase, smart contracts are created to automate auditing procedures, and the network architecture is configured.

4. Training and Scaling. Comprehensive training for auditors and IT staff. After successful training and stability testing, the system is gradually expanded to other departments and processes.

5. Continuous Monitoring and Optimization. Ongoing surveillance of the system's effectiveness following implementation. Data analysis is performed to identify new opportunities and to develop recommendations for optimizing processes and expanding functionality.

Currently, private and consortium blockchains are likely to be the first to be adopted in business for several key reasons. First, they provide better protection for a company's sensitive information. Second, they allow for tiered access for stakeholders, ensuring better control over who can view or update the ledger. These systems also lower the cost of verifying transactions, as the consensus mechanism is less resource-intensive. Furthermore, they facilitate a quicker exchange of accounting records with both internal and external parties. Private blockchains strengthen control over participants, allowing for faster transaction verification, and they offer greater flexibility in committing or reversing transactions, which is a significant advantage in modern business.

Conclusions

The study confirmed that the integration of cloud technologies and blockchain marks a new stage in the development of control systems, transforming auditing from a retrospective review to a continuous and proactive process. This is due to the key properties of these technologies. Cloud solutions provide the necessary scalability and flexibility to process huge amounts of data, which allows auditors to effectively analyze information and optimize their procedures. Blockchain, for its part, guarantees the immutability, transparency and authenticity of transactions, which is critical for combating fraud and corruption. The analysis showed that the implementation of blockchain in auditing creates a noticeable economic effect, in particular, by reducing the duration of audit inspections and operating costs. The use of these technologies contributes to the automation of routine procedures, which allows auditors to focus on strategic analysis and risk forecasting.

Despite the significant advantages and economic effect, key challenges that hinder the widespread implementation of these solutions have been identified. These include cybersecurity threats, dependence on network infrastructure, difficulty in integrating with existing systems, and Ukraine's fragmented regulatory framework.

Taken together, these factors create a challenging transition period for Ukrainian audit practice. Innovations provide powerful tools for improving efficiency, but their full implementation is possible only after overcoming existing legislative and organizational barriers. Only harmonization of legislation, adaptation of standards, and development of strategies to overcome organizational challenges will allow the full potential of cloud technologies and blockchain to be realized, ensuring reliability and transparency of financial control in the conditions of the modern digital economy.

To realize the full potential of cloud and blockchain in auditing, future studies should focus on several key areas. First, it is crucial to create hybrid audit models that combine traditional and digital methods to build flexible and adaptable systems that minimize risk. Furthermore, it is advisable to establish standards for private and consortium blockchains to build trust and encourage their widespread use. Additionally, it is essential to investigate the new skills and competencies that auditors and accountants will need to operate effectively in a digital environment, as well as to develop training programs to prepare these professionals.

To fully unlock the potential of cloud technologies and blockchain in auditing, future research should focus on several key areas that will help bridge existing theoretical and practical gaps.

1. Research on efficiency and economic impact. Despite the theoretical advantages, there is an urgent need for empirical data confirming the economic effectiveness of implementing these technologies. Future research should include quantitative methods, such as surveys of audit firms and case studies of specific enterprises. This will allow assessing the impact of cloud solutions and blockchain on reducing time, operating costs and risks, as well as on increasing auditor productivity.

2. Study of the regulatory environment. The existing regulatory framework in Ukraine remains fragmented, which is a significant challenge for the implementation of innovations. Further research should focus on a comparative analysis of the legislation of Ukraine and countries with a developed digital market. This will allow developing specific recommendations on harmonizing the regulatory framework, adapting standards, and creating favorable conditions for the widespread use of digital technologies in auditing. The methodological approach may include an analysis of regulatory acts and interviews with experts from regulatory authorities.

3. Analysis of new skills and competencies. The implementation of innovative technologies requires auditors and accountants to acquire new knowledge. Research should be conducted to determine which competencies (in the field of data analysis, cybersecurity, and programming) will become key in the future. The methodology may include indepth interviews with leading auditors and an analysis of educational programs to develop recommendations for updating curricula in higher education institutions and professional certification programs.

The implementation of these areas will not only deepen scientific knowledge, but will also provide a practical basis for the successful digital transformation of auditing in Ukraine.

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