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INNOVATIVE TECHNOLOGIES IN ACCOUNTING AND AUDITING: THE USE OF BLOCKCHAIN TECHNOLOGY

ABSTRACT

The aim of the research is to provide justification for the use of Blockchain technology in the field of accounting and auditing. The main findings of the study indicate the potential advantages of using Blockchain technology in financial transaction accounting and auditing. Risk analysis has demonstrated that the implementation of Blockchain can help reduce the likelihood of accounting errors and ensure a higher level of information security. The utilization of Blockchain in transaction accounting can lead to a decrease in penalties associated with accounting mistakes, as well as facilitate faster detection and correction of errors without additional financial expenses. Moreover, Blockchain technology can practically eliminate the loss of financial information and its misuse by malicious actors. The obtained research results highlight the significance of implementing Blockchain in organizational and technological schemes of transaction accounting, as well as in the field of accounting and auditing as a whole. The implementation of this technology can optimize accounting processes, improve the accuracy and reliability of financial information, provide more effective control, and reduce risks for economic entities. According to the results of risk-oriented modelling, the implementation of Blockchain technology in organizational and technological schemes of financial transaction accounting allows for a 3.1 times reduction in the risk of accounting errors and a significant improvement in information security by 99.9 times compared to traditional methods. This indicates the potential benefits of using Blockchain in the accounting field as a systemic optimization solution. The obtained results emphasize the importance of further research and implementation of Blockchain to enhance the quality of financial accounting, ensure reliability, and mitigate risks in this sphere.

Keywords: blockchain, accounting, decentralization, digital economy, digitalization

JEL Classification: G140, G150, G170, G190

INTRODUCTION

One of the current problems in the accounting system is the lack of automation and digitalization of processes, which can lead to errors and loss of time to perform routine tasks. In addition, there is the problem of insufficient security and confidentiality of data, which can lead to its loss or disclosure to third parties (Bozhkova & Halytsia, 2022; Rawashdeh, Bakhit, Abaalkhail, 2023). Bringing in innovative technology and modern solutions contributes to solving systemic problems in the accounting system. The use of digital tools such as cloud technology, distributed databases, and automated accounting systems can reduce routine work and reduce the risk of errors. More accurate and efficient accounting is possible through the use of innovative technologies such as artificial intelligence, machine learning, and data analysis (Prokopenko et al., 2019; Bushman, 2021; Tkachuk et al., 2022). The use of blockchain technology contributes to solving the above problems by providing secure and reliable data storage and transmission without trust in intermediaries and reducing the risks of error. The decentralized structure of blockchain allows each user of the network to control their data and ensure its confidentiality, which reduces the risks of its loss or disclosure (Han et al., 2023; Al Shanti & Elessa, 2023; Singh, Joshi, & Sharma, 2023).

Blockchain is a promising technology with a concrete financial dimension: the blockchain market is projected (Demand Sage, Ruby 2023) to be USD 163.83 billion by 2029. (with

an average annual growth rate of 56.3%), (Statista, Taylor, 2022) expect a USD 19 billion increase in the cost of implementing practical blockchain technology solutions. (Findstack, Carter, 2023) estimate that the application of blockchain will increase global GDP by USD 1.76 trillion, (Wallabit Media LLC, Tuwiner, 2023) note that the introduction of blockchain technology in the economic sector, in particular the banking sector, has the economic potential to reduce the cost of banking infrastructure and procedural operations by 30% (about USD 10 billion per year). The National Bank of Ukraine (Grand View Research, 2023) expects an acceleration of the average annual growth rate of the profile market to 87.7% (by the end of 2023) and highlights Ukraine among other countries that have significant potential for the implementation of the investigated technology. Thus, we state that blockchain technology has a wide potential for implementation in various fields of human activity and is also a practical tool that will allow to significantly optimize the accounting and auditing sector, which is particularly confirmed by relevant research (Casella et al., 2023; Liu, Han, & Zhu, 2023; Jebamikyous et al., 2023). The implementation of blockchain technology in accounting can significantly improve the efficiency and security of accounting operations and ensure the reliability of data storage (Singh et al., 2023; Oladejo, 2023; Jayasuriya, & Sims, 2023), which is a must when organizing the functioning of economic-commercial activities in the E-commerce and Digital Economy paradigm (Shukla, & Shyam, 2023; Shi, 2023; Guntara & Nurfirmansyah, 2023).

LITERATURE REVIEW

The issue that is the main paradigm of the current study is numerous errors in accounting and auditing. Research on errors in accounting and auditing is extremely important for several reasons that can be substantiated on the basis of the data presented (Majewski, 2018):

- 1. Financial consequences: The nearly USD 7 billion in fines imposed on U.S. companies due to mishandled data and spreadsheet errors demonstrates the significant financial impact of improper accounting. These fines can have a significant impact on a company's profitability and ability to operate efficiently. Error research can help identify the underlying issues that cause errors and develop strategies to prevent them.
- 2. Tax problems: The percentage of accounting errors due to incorrect tax data entry is 27%, according to a Bloomberg's BNA study from 2015. This can lead to serious tax problems for companies, including overpayments or underpayments of taxes, as well as potential IRS audits and penalties. Error research can help identify the causes of such errors and develop procedures to avoid them.
- 3. Low level of measurement and management of internal processes: Data shows that only 4% of Polish companies measure and manage internal processes. This means that most companies do not have proper mechanisms to control and improve their accounting and auditing processes. Error studies can identify weaknesses in existing processes and offer recommendations for improvement, which will contribute to the efficient performance of accounting duties and reduce the likelihood of errors.
- 4. Increase the level of trust: Research into accounting and auditing errors can help increase the level of trust in companies' financial statements. If companies can demonstrate their ability to detect and correct errors, this will help to increase the trust of stakeholders such as investors, creditors and regulators.

In general, research into accounting and auditing errors is important for the financial stability of companies, fulfilment of tax obligations, improvement of internal processes, and increase of trust. These studies can point out problematic aspects and offer recommendations for improving the accounting and auditing system, which will contribute to the effective management of companies' finances.

Drábková & Pech, 2019 emphasize that financial statements are the main source of information for different groups of users. The quality of the information received has a significant impact on decision-making based on accounting data. Based on the results of the analysis of financial statements for the company selected in the study, the authors found that the reporting of financial income of the accounting unit had significant discrepancies, which in turn led to a distortion of its economic essence and cash flow generation. The researchers recommended that auditors and corporate management conduct detailed audits in these areas of accounting, as a significant risk of accounting errors and fraud was identified. Potential investors are not recommended to invest in the company under study, given the identified risk of manipulating earnings and off-balance sheet financing, which may affect the reported cash flows.

The following main conclusions can be drawn from the study (Boisseau-Sierra, Chu & Rajgopal, 2023) on the consequences of errors in public accounting: a. Detection of errors: the study found that Eurostat is more likely to comment on the financial statements of the European Union member states. This indicates that there are errors in public accounting that require attention and correction; b. Factors influencing errors: the authors found that Eurostat is more likely to issue comments to countries where the difference between changes in public debt and deficit is high relative to GDP, countries

with worse economic conditions and countries where central banks hold more government bonds. These factors may contribute to the occurrence of errors in public accounting; c. Implications for financial markets: researchers have found that the announcement of Eurostat's observations on government financial reporting is accompanied by an abnormal increase in government bond yields. This effect is particularly noticeable when the observations point to deficits or debt and when such an impact is specifically estimated. In addition, the study shows that domestic investment in government debt increases after the announcement of the observations. These findings highlight the importance of accurate and reliable public accounting. Errors in financial reporting can have a serious impact on financial markets and domestic investment. The study emphasizes the need for close monitoring and management of public financial reporting to ensure the reliability and credibility of member states' financial information.

Thus, the results of the study by Drábková & Pech (2019) and Boisseau-Sierra, Chu & Rajgopal (2023) show that accounting errors affect not only the financial performance of local companies but also are destabilizing factors on the scale of individual countries or even cross-border entities, Therefore, it is highly advisable to focus the relevant research vectors on identifying means and mechanisms that help reduce or completely eliminate the negative effects of errors in financial statements.

Globalization, unification and the use of modern digital systems and tools in the field of accounting and auditing have led to a deepening of the problem of information security of financial transactions.

This issue is clearly demonstrated by the results of the study by Wang et al.:

1. Revolution in the accounting field: The development of computer networks has significantly changed the traditional accounting discipline. The cybernetic nature of network accounting determines that information security is key to network accounting (Müller, W., Kuznetsova, A., Khrystoforova, O., Karpachova O., & Sulyma, M. (2021)).
2. Risks of the accounting information system: The risk of the accounting information system mainly arises from three aspects. Firstly, the storage of accounting information on the network has changed the traditional way of storing information, replacing the traditional paper method with electronic storage, which endangers the security of information storage. Secondly, with the constant development of Internet technologies, computer and system viruses have many variable forms and types, which makes them difficult to identify. Finally, in a networked accounting information system, all data transfers depend on the network or storage devices and the risk of data loss and misuse during transmission increases.
3. The importance of information security: The results of the study emphasize the importance of information security measures in network metering. Ensuring the confidentiality, integrity and availability of accounting information becomes a key task for the effective and reliable functioning of network accounting.

Therefore, for the successful implementation of network accounting, it is necessary not only to take into account the advantages of the technology but also to carefully address the problems of information security.

Taking into account the identified risk factors: errors in accounting for financial transactions and reporting and vulnerabilities in ensuring information security of the industry under study, more and more researchers and subject matter experts are paying attention to the modern digital product - Blockchain technology (Shah, Jhanjhi & Laraib, 2023; Yang & Yin, 2023; Alkafaji, Dashtbayaz & Salehi, 2023).

Blockchain technology is a distributed database that ensures the safe and secure storage and transmission of information. Each block contains information about previous blocks, making it reliable and resistant to change. Each new block is attached to the blockchain, making the entire system interoperable and reliable. Blockchain is typically used for storing and transferring cryptocurrencies but can be used in many other industries such as supply chain management, financial services, healthcare, and more. To establish the current trends and conceptual framework for the use of the investigated technology in the field of accounting and analysis, let us perform a review of current profile publications and research papers.

The article (Han et al., 2023) is a literature review of the application of blockchain technology and artificial intelligence in accounting and auditing. The authors reviewed over 100 academic studies to explore the potential benefits and challenges of using these technologies. They found that the use of blockchain can help provide secure and efficient data storage and transmission, improve the accuracy and speed of transactions, reduce infrastructure costs, and provide greater transparency and reliability of the information. The use of artificial intelligence can also improve automation, analysis, and prediction processes in accounting and auditing. However, the authors note the need for more research to identify best practices and develop appropriate regulatory mechanisms. The article reviews the literature on the application of blockchain tech-

nology and artificial intelligence to accounting and auditing. The authors point to the high potential of using these technologies to improve the efficiency of accounting and auditing processes, reduce fraud risks, and produce more accurate and reliable financial reporting. The authors point to the need for further research and development of appropriate regulatory mechanisms for implementing these technologies in accounting practices. An article (Al Shanti & Elessa, 2023) investigates the impact of digital transformation on the use of blockchain technology in the banking industry to improve the quality of accounting information and the efficiency of corporate governance. The paper analyzed the use of blockchain in banking, the specifics of the application of the technology in accounting and corporate governance, and the benefits and challenges associated with its application. The researchers concluded that the use of blockchain technology can improve the quality of accounting information and the efficiency of corporate governance in banking, but a number of challenges need to be addressed, such as regulation and data protection. Various approaches to the use of blockchain technology in the banking sector are analyzed and research findings are reviewed that point to the potential benefits of using this technology in improving the quality of accounting information and ensuring effective corporate governance. The authors conclude that the implementation of blockchain technology can be beneficial to the banking sector if the specifics of this industry are taken into account and if the implementation of projects based on this technology is properly approached.

In an article (Singh, Joshi, & Sharma, 2023), the authors conducted research on how blockchain technology can transform accounting, auditing, and finance. The article looked at examples of the use of blockchain technology in accounting for financial transactions, the use of smart contracts to automate financial transactions, improving audit processes and combating financial crime. The authors also explored the use of other technologies, such as machine learning and artificial intelligence, to improve accounting and auditing, and provided several examples of the use of these technologies. The article conducts a systematic review of the literature on the use of blockchain technology in accounting, auditing, and finance, and the findings address the following aspects: blockchain can significantly improve the efficiency, security, and accuracy of financial reporting, given its potential for transaction tracking, process automation, and smart contracts; however, for blockchain technology to be widely used in accounting and auditing, problems with its scalability, standardization and the privacy and protection of personal.

The study (Oladejo, 2023) focuses on examining how blockchain technology can change the way accounting and auditing are approached. The study includes an analysis of various aspects of blockchain applications, including security, reliability, efficiency, and cost-effectiveness. The study also explores the potential applications of blockchain for financial reporting sustainability and auditing in the accounting industry. The results of the study show that blockchain can be a strong tool for improving accounting and auditing processes, but several technical and organizational issues need to be addressed. The dissertation concludes with a number of recommendations for further research and implementation of blockchain in the accounting field. The main findings of the study are that blockchain can be a significant source of benefit to the accounting and auditing professions because it can provide improved efficiency of information exchange, reduced risks of data falsification, and increased openness and transparency. The study also notes the need to understand and examine the risks associated with the use of blockchain and to address the legal issues of its application. In addition, the author emphasizes the need to change the culture and relationships between the participants in order to successfully introduce blockchain into the accounting and auditing profession.

The article (Singh et al., 2023) focuses on how blockchain technology is changing accounting, auditing, and finance. The research was conducted through a systematic literature review in which the authors analyzed 46 academic articles on the use of blockchain technology in finance. The authors found that the use of blockchain can provide greater efficiency and security in accounting and auditing. In particular, the use of this technology allows for a secure data storage system that is open and cannot be changed without prior authorization. Blockchain can also enable automated communication between different financial institutions, reducing the risk of errors and limiting the possibility of fraud. The study also found that the use of blockchain technology can provide greater transparency and accessibility to financial information for all market participants. In addition, blockchain can increase the efficiency of risk management processes and fraud detection. Overall, the paper demonstrates the potential of blockchain technology to transform accounting, auditing, and finance, and highlights the need for further research into this technology and its application across industries. The authors draw the following conclusions about how blockchain is changing accounting, auditing, and finance:

Blockchain can make financial transactions more secure and provide greater transparency of financial transactions; blockchain technology can help improve the efficiency of the audit process; the use of blockchain can help address problems related to inaccuracy and lack of quality in financial reporting; the adoption of blockchain can reduce transaction costs associated with storing, processing and transmitting financial information; The use of artificial intelligence along with blockchain can help improve accuracy and s Overall, the authors argue that blockchain can be useful for improving efficiency and reliability in accounting, auditing, and finance, as well as reducing the costs of these operations. However, for

blockchain to be implemented successfully, regulatory issues and interoperability with other systems and standards must be addressed.

The article (Jayasuriya, & Sims, 2023) explores how blockchain can impact accounting and financial management. The study includes an analysis of the history of accounting development as well as a review of various studies using blockchain in accounting, auditing, and financial management. The article provides examples of the use of blockchain for various financial transactions, such as recording payments, e-voting, and storing securities. The researchers also discuss how artificial intelligence and machine learning can be used to improve accounting and auditing. As a result, the authors conclude that blockchain could be the next big tool for accounting and financial management because it can provide security, accuracy, and transparency to transactions. However, a number of technical, legal, and regulatory issues need to be resolved for blockchain to be used effectively. The authors analyze the traditional approach to accounting and consider how blockchain technology applies to various aspects of accounting, such as currency transactions, production accounting and taxation. The authors conclude that blockchain technology can provide more accurate, fast, and secure accounting for financial transactions and improve accounting efficiency. However, according to the authors, the successful implementation of blockchain technology in accounting requires a highly skilled workforce and a proper regulatory framework.

Thus, the analysis of relevant and profile publications allows us to conclude that blockchain technology has significant potential for implementation in the accounting and auditing sector and has corresponding advantages and challenges (disadvantages) for integration into the investigated industry. Advantages of adopting blockchain technology in the accounting and auditing sector include increased security: blockchain technology can provide a high level of security for transactions and storage of financial information as data is stored in a distributed network; reduced costs: blockchain can help reduce accounting and auditing costs through more efficient transaction processing and a reduced need to use intermediaries; transparency: blockchain technology can provide Disadvantages of introducing blockchain technology into the accounting and auditing sector may include: complexity: blockchain technology can be difficult to use and understand for users inexperienced with the technology; infrastructure requirements: using blockchain may require high infrastructure costs, including network servers and equipment; regulation: blockchain technology in many countries does not have clear legislation, which can lead to difficulties in using and understanding the legal aspects. Accordingly, finding possible solutions for the rational and thorough implementation, integration and application of blockchain in the accounting industry is an urgent task that has direct instrumental, structural, and financial implications.

AIMS AND OBJECTIVES

The purpose of the study is to prove the effectiveness of the use of Blockchain technology in the field of accounting and auditing, taking into account the identified risk factors: errors in reporting and information vulnerability.

Objectives of the study:

1. Establish the actual capabilities of Blockchain technology and their practical application in the field of accounting and auditing.
2. To perform a comparative analysis of typical and modernized by technological solutions of Blockchain technology organizational system of accounting support of financial and economic operations.
3. To form an evidence base on the benefits of using Blockchain technology to improve the efficiency and sustainability of accounting systems.

METHODS

In order to achieve the goals and objectives, the following methods were used in this study:

1. Information and analytical review of the practical possibilities of Blockchain technology in the field of accounting and auditing. This review included a study of scientific literature, relevant articles, technical documents and practical applications of Blockchain in the context of accounting and auditing. It helped to identify the opportunities and benefits of using Blockchain in improving accounting and auditing processes.
2. Comparative analysis of organizational and technological schemes of accounting support of financial and economic operations. This analysis included a comparison of various accounting and audit schemes, including traditional and Blockchain-based ones. The study took into account organizational and technological aspects and analyzed the advantages and disadvantages of each scheme, as well as their suitability in the context of accounting.

3. Risk-oriented modelling with further comparative analysis of the results regarding the benefits of using organizational and technological schemes based on Blockchain technology. This stage of the study included the identification of risks related to accounting and auditing and their modelling with the use of Blockchain technology. Comparison of the results of the analysis allowed us to assess the extent to which the use of Blockchain can reduce risks and improve the efficiency of processes in the field of accounting and auditing.

These methods allowed for in-depth analysis and evaluation of the use of Blockchain technology in accounting and auditing. The results of the study are the basis for the development and implementation of organizational and technological schemes for accounting support of financial and economic operations based on technological solutions and smart contracts of Blockchain technology.

RESULTS

Based on the results of the information and analytical review, the advantages and features of the use of blockchain technology in accounting and auditing are identified. Based on Review Research's tools, let's establish the practical applications of blockchain technology in accounting (Cheng et al., 2023; Stafie & Grosu, 2023; Peter, & Vukovljak, 2023):

1. Authentication: Blockchain can be used to authenticate financial information, including invoicing and payments. This can reduce the risk of financial fraud and increase the reliability of reporting.
2. Data Retention: Blockchain can provide secure data storage, which is important for the accounting and auditing sector. Secure data retention can help ensure the accuracy of financial reporting.
3. Transaction tracking Blockchain can help track financial transactions and reduce the risk of fraud and error. It can improve the efficiency of accounting and auditing processes.
4. Process automation: Blockchain can be used to automate many accounting and auditing processes, which can improve efficiency and reduce the risk of errors.

Summarizing the application of blockchain technology, it can improve efficiency and security in the accounting and auditing sector, reduce the risks of financial fraud and improve the accuracy of financial reporting.

Integrating blockchain technology into accounting and auditing processes can provide a high level of accuracy and security for records and transactions. Key mechanisms for integrating blockchain into these processes include (Shah, Jhanjhi & Laraib, 2023; Morton & Curran, 2023; Petchenko et al., 2023; Cazazian, 2022; Bellucci, Cesa Bianchi & Manetti, 2022):

1. Decentralized data storage: Blockchain can be used to create a decentralized data storage system in which information is stored on different nodes of the network, ensuring a high level of data security and availability. This can become important for accounting and auditing, as these processes need to store large amounts of data.
2. Transaction validation system: blockchain can be used to create a transaction validation system, which allows to confirm the correctness of transactions and ensure a high level of reliability of financial reporting.
3. Access control system: blockchain can be used to create a system to control access to data, providing a high level of security and protection of sensitive information.
4. Process automation system: blockchain can be used to create a process automation system, allowing for the automation of accounting and auditing processes, ensuring high accuracy and efficiency of these processes.
5. Identity validation system: Blockchain can be used to create an identity validation system, which is very important for ensuring security and confidentiality in the accounting and auditing sectors. Traditional identification methods such as passwords and PINs can be easily compromised, whereas blockchain can provide a secure and reliable way of identification.
6. Audit system: blockchain can be used to create an audit system that allows for accurate and reliable auditing. Blockchain can provide a secure and immutable transaction log that can be used to track all transactions and ensure that they are recorded correctly. In addition, blockchain can help identify possible fraudulent schemes and accounting inconsistencies.
7. Reporting system: Blockchain can be used to create a reporting system to ensure the accuracy and reliability of financial reporting. Blockchain can provide an immutable transaction log that can be used to create accurate and reliable financial reports.

8. Cost control system: blockchain can be used to create a cost control system to provide effective control over the company's expenses. Blockchain can provide a secure and immutable transaction log that can be used to track a company's expenses and spending. This allows the company to track every transaction in its system and to provide more accurate and effective control over its costs.
9. Data storage system: Blockchain can be used to create a data storage system that allows for security and protection against unauthorized access to company data. Blockchain provides storage of data in a decentralized network, which makes it more secure and reliable. In addition, blockchain can provide protection against data changes because any change must be validated by all members of the network.
10. Tax Process Optimization: Blockchain can be used to streamline tax processes, ensuring the accuracy and efficiency of tax accounting. Blockchain can provide an immutable transaction log that contains all relevant transaction information, enabling effective tracking of a company's tax obligations.

Thus, blockchain technology can be used to create systems that automate processes, validate identity, reporting, control costs, store data and streamline tax processes in the accounting and auditing sector. The adoption of blockchain technology in accounting and auditing processes may face some challenges and problems (Yawalkar et al., 2023; Li et al., 2023; Du et al., 2023; Vardia & Singh, 2022; Spanò et al., 2022):

1. Low readiness for adoption: There is a high level of ignorance of blockchain technology and its potential among accounting and auditing professionals. Many companies may not have the necessary readiness to adopt this technology into their processes.
2. High costs: Implementing blockchain technology can be a costly process that can require high development, implementation and support costs.
3. Standardization: Lack of standards can make it difficult for different companies and systems using blockchain to work together. Without standardization, interoperability and security issues can arise.
4. Data privacy: Blockchain is based on the principle of publicity, so there can be problems with protecting sensitive information. Proper protection of the data stored in the blockchain must be ensured.
5. Legality: There are legal challenges associated with storing data in the blockchain, also with the legal certainty of blockchain technology. These issues need to be addressed before implementing the technology.
6. Low transaction speed: While blockchain can be effective in ensuring the security and accuracy of accounting and auditing, it can be slow compared to traditional data processing systems. This can be particularly problematic when large numbers of transactions need to be conducted in real-time. For example, blockchain transaction processing speed may be an issue in the banking sector.
7. Compatibility with existing systems: The use of blockchain may require integration with existing accounting and auditing systems, which can be quite complex and require significant effort. There may also be compatibility issues between different versions of blockchain and different protocols.
8. Staff training: The use of blockchain may require specialized knowledge and skills on the part of accounting and auditing professionals. This can be problematic if companies are inexperienced in this area and cannot provide adequate training for staff.

Accordingly, the use of blockchain technology in accounting and auditing processes can help improve the efficiency and accuracy of those processes. But it can also face challenges and problems related to knowledge, cost, standardization, data privacy, legality, transaction speed, interoperability and staff training. Before implementing blockchain, these challenges must be thoroughly understood and appropriate solutions found to address them.

In accordance with the proposed research scheme, we will further carry out a comparative analysis of the typical and modernized (by means of blockchain technology) organizational and technological schemes of accounting support for financial and economic transactions on the example of simple transactional interaction.

A typical organizational and technological scheme for accounting support of financial and economic transactions between two companies may look like this (Figure 1):

1. Financial transactions: Company 1 and Company 2 conduct financial transactions with each other, such as selling goods or services, receiving payments, paying suppliers, paying salaries, etc.
2. Accountants: Company 1 and Company 2 each have their own accountants who are responsible for recording financial transactions. Company A's accountant records financial information about transactions related to Company A in its accounting system. Company B's accountant does the same for transactions related to company B.

3. Financial statements: Each company prepares its accounting statements separately. This includes financial statements, which consist of a balance sheet, income statement, and statement of changes in equity. The reports are prepared in accordance with internal and external accounting standards and are submitted to the respective companies.
4. Auditors: To ensure independent confirmation of the reliability of financial information and compliance with accounting standards, each company may engage external auditors. Auditors independently review financial records, and processes and monitor compliance with accounting standards in each company.

It should be noted that the typical organizational and technological scheme of accounting support for financial and economic transactions between two companies also has its drawbacks:

1. Increased amount of manual data entry: In the traditional scheme, each company's accounting department manually enters transaction data, which increases the risk of errors and can lead to delays in accounting.
2. Duplication of work: Each company prepares its own financial statements, which can lead to duplication of work and unnecessary costs.
3. Limited availability of information: In the traditional scheme, access to financial information is limited to companies and their auditors, which can make it difficult for parties interested in the financial condition of companies to cooperate and make decisions.
4. Vulnerability to errors and fraud: The traditional scheme is subject to the risk of accounting errors and the possibility of financial fraud, as information can be subject to unauthorized interference or falsification.
5. Delays in interaction: The exchange of financial information between companies and their accountants may be subject to delays and require additional resources to ensure interaction and reporting.

Given these shortcomings, it makes sense to consider using modern technologies, such as Blockchain, to improve the efficiency and security of accounting support for financial and economic transactions between companies.

The organizational and technological scheme for accounting support of financial and economic transactions between two companies (1 and 2) based on Blockchain technology may include the following steps (Figure 1):

1. Create and verify the transaction: Company 1 and Company 2 create a transaction that records the exchange of financial resources or other assets. This transaction is created as a data block.
2. Encryption and hashing: The transaction is encrypted and hashed using cryptographic algorithms. The hash code of the transaction becomes part of the block.
3. Distribution of the block between participants: The created block containing encrypted transactions is distributed among the network participants. Each participant receives a copy of the block, which allows for a distributed data storage system.
4. Confirmation and mining: Network participants, such as miners, carry out the process of confirming transactions and adding a block to the blockchain. This process may involve solving complex math problems or other mechanisms that ensure the security of the network and prevent double-spending.
5. Data storage and security: Each block in the chain contains a hash code of the previous block, making the system inaccessible to past changes. This ensures data integrity and reliability. In addition, using cryptographic mechanisms, the information in the blocks is protected from unauthorized access.
6. Automatic updating of accounting records: After the block is confirmed and added to the chain, the accounting records are automatically updated in the systems of companies 1 and 2. This provides almost instant and accurate information about financial transactions.

Such an organizational and technological scheme based on Blockchain allows for transparency, reliability, and security of financial accounting and reporting between companies. It reduces the risk of errors, simplifies verification and audit processes, and facilitates interaction and cooperation between companies.

The main differences between accounting and auditing systems with/without technology are illustrated by the example of accounting transactions between two notional companies (Figure 1).

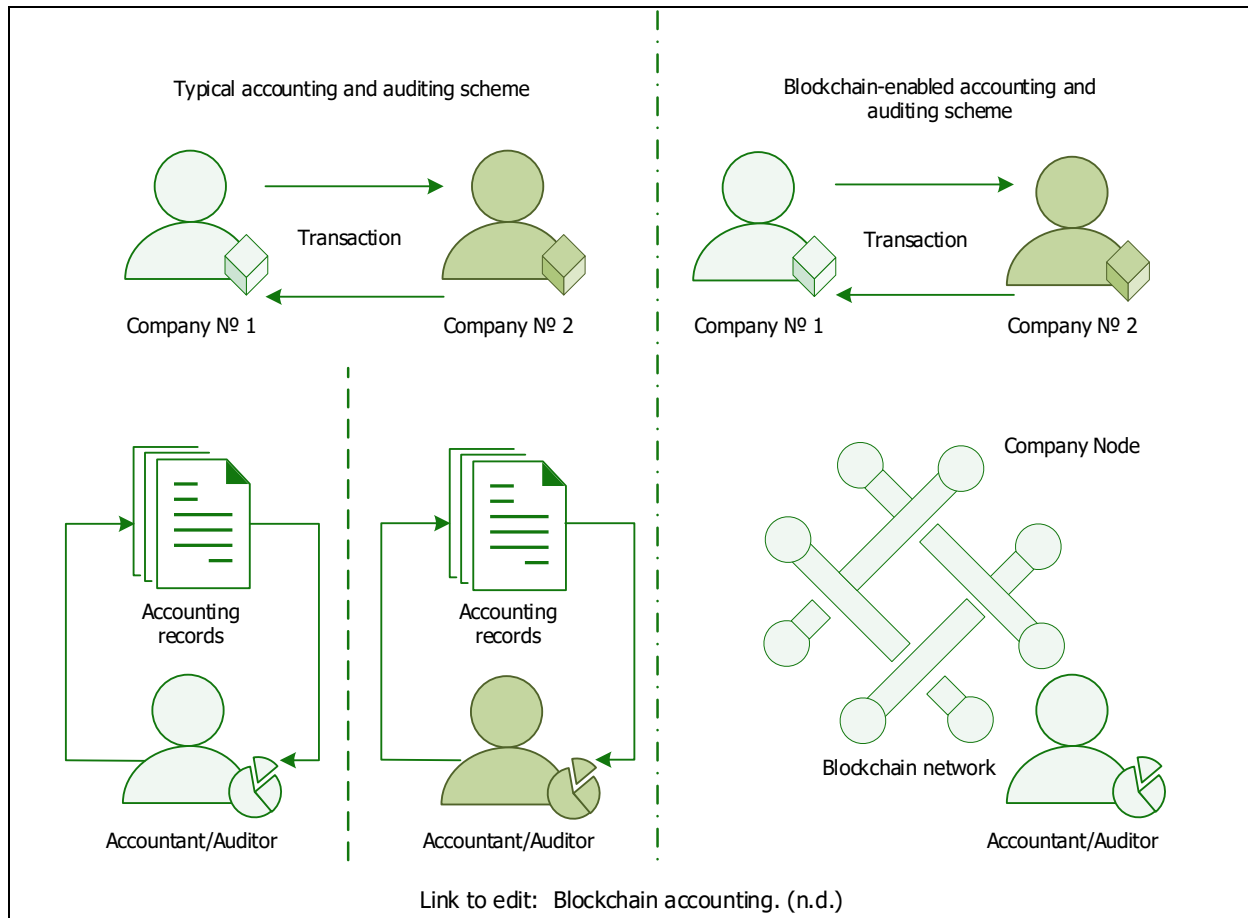


Figure 1. Differences in the organization of accounting and auditing operations in a typical system and an innovative system with the introduction of blockchain technology.

The above data (Figure 1) illustrates that even for a typical financial-currency transaction scheme between two notional companies, blockchain technology greatly simplifies the auditing infrastructure, ensuring the confidentiality and security of critical information while reducing the resource costs of organizing the latter. This indicates the potential for cost savings with greater efficiency and productivity in the accounting system, resulting in a favourable investment climate and an increase in the associated financial flows. Accordingly, the established characteristic mechanisms of the positive impact of blockchain technology on the accounting industry correlate with the predictions of specialized organizations identified in the rationale for the relevance of the vector under study.

The use of an organizational and technological scheme for accounting support of financial and economic transactions based on Blockchain technology has several advantages over the traditional scheme:

1. **Data reliability and integrity:** Blockchain provides reliable data storage because each block contains a hash code of the previous block. This makes the system resistant to changes and complicates the possibility of data falsification.
2. **Decentralization:** Blockchain is based on a distributed network where each participant has a copy of the database. This eliminates a single central point of vulnerability and provides greater security and resilience of the network.
3. **Transparency:** All network participants can view transactions, which provides a high level of transparency and openness. This is especially important for auditors and parties interested in the financial condition of companies.
4. **Efficiency and speed:** Blockchain allow for automatic data updates, which simplifies and speeds up accounting and reporting processes. This helps to reduce the time spent on manual data processing and verification.
5. **Collaboration and interaction:** Blockchain create a favourable environment for collaboration between companies as all data is available in real-time. This makes it easier to share information and work together on financial transactions.

The use of Blockchain in the accounting support of financial transactions can improve the security, efficiency, and reliability of accounting and reporting processes. It also promotes trust between the parties, simplifies audits, and ensures a more transparent and efficient exchange of financial information. Thus, the main hypothesis of the current study is formed: Blockchain technology significantly reduces the risks of errors and information vulnerability of accounting and auditing

operations, which has direct financial implications (Suslenko, V., Zatonatska, T., Dluhopolskyi, O., & Kuznyetsova, A., 2022).

The formed hypothesis requires appropriate verification. According to the proposed methodology, this study will use risk-based modelling.

Based on Review Research's tools, established a risk system for the accounting and auditing industry (Al-Tae & Flayyih, 2023; Ahmed & Habeeb, 2023; Kend & Nguyen, 2022):

1. The risk of inefficient costs is associated with economically unjustified expenses for the organization of accounting. The most common reasons for such costs include overstaffing of the accounting department, duplication of functions, inefficient use of accountants' working time, overstatement of the payroll compared to standard indicators, and inadequate use of accounting automation software. These risks may arise from insufficient adaptation of the accounting system to the needs of a particular company, or the use of software products not designed for small or medium-sized enterprises.
2. The risk of a decrease in control has a direct impact on the quality of accounting information, management decision-making, and the reputation of the economic entity. Since control is exercised directly by a person, an official, minimizing the distribution of control functions or maximizing them can lead to a decrease in the level of control and the emergence of various threats. Minimizing the distribution of functions leads to centralization of management and threats to self-control: if business operations and the quality of the generated information are controlled by a limited number of decision-makers, the objectivity of decision-making decreases. On the other hand, maximizing the distribution of functions poses a threat of decentralization, dispersion of responsibility, and increased risk of inefficient spending.
3. The risk of decreased efficiency arises when there are remote divisions and no permanent accountant or accounting department in the economic entity. This can lead to delays in accounting procedures, untimely data reflection, data distortion and slower management decision-making, as well as other negative consequences. The remoteness of departments can complicate communication and the exchange of necessary information, which disrupts the efficiency of accounting processes. The absence of a permanent accountant or an accounting department may create instability in the performance of accounting duties and delays in the processing of financial data.
4. The risk of reduced reliability is associated with the distortion of accounting data due to imperfect accounting organization, internal control system and other factors. The factor of "incomplete accounting" should be noted separately, when not all the rules and elements of the accounting method are applied to generate information about the activities of an economic entity in full. A special feature, in this case, is also the use of simplified accounting methods, including simplified accounting (financial) statements. This can lead to distortion of financial information, unreliable reporting and violation of accounting rules and regulations.
5. The risk of distrust is associated with the emergence of doubts about the reputation of an economic entity on the part of stakeholders. From the perspective of accounting, the risk of distrust is manifested in the forms and methods of accounting, which can be externally assessed as one of the criteria for the implementation of various illegal schemes and cause threats of increased control by regulatory authorities, litigation and increased costs. The risk of distrust leads to complications in communication, building business relationships, and transactions due to factors that previously negatively affected the reputation of an economic entity as a result of providing inaccurate information, fraud, dubious business schemes, non-payment of debts to creditors, and frequent litigation.
6. The risk of centralization is a special case of the risks of reduced control and distrust. In the first case, when accounting is centralized in economic entities with remote units, there is a threat of intentional misrepresentation of information by the units for personal gain, which is the result of reduced control. In the second case, if an economic entity keeps records for other entities without proper specialization, this form of centralization may indicate consistent relationships, such as centralization of management, the interdependence of persons and business fragmentation, which may be considered by the controlling authorities as a criterion for the implementation of illegal activity schemes.
7. The risk of information leakage is a specific case of the risks of reduced control and centralization risks. This risk can pose a threat of leakage of restricted information (such as personal data and trade secrets) into the public space. This information can also be used by malicious actors, etc. An increase in the threat of information leakage is directly related to a decrease in control. Proper organization of the internal control system reduces the threat of information leakage. Also, the threat of information leakage increases if accounting is provided by an external contractor (the second form of accounting centralization).

8. Risk of errors. The human factor can cause errors in accounting and reporting, such as incorrect data entry, misclassification of transactions, or miscalculation of financial indicators. This can lead to inaccuracies in financial statements and unreliable information for decision-making.
9. Risk of fraud and forgery. Insufficient control over accounting processes may create a risk that unscrupulous employees or external parties may use them to falsify financial data. This may include altering records, forging documents, or even fictitious transactions for the purpose of illicit enrichment or misrepresentation of the company's financial position.
10. Risk of non-compliance with the law. Failure to comply with accounting standards, tax laws, and other regulatory requirements may result in financial penalties, lawsuits, loss of reputation, and other legal consequences for the company.

Given the established system of risks, let's identify the most likely ones. According to Majewski (2018), the most likely risk is the risk of errors: a large number of data entry errors is a common problem, causing 27.5% of all manual errors in accounting. Data sources can be diverse: paper documents, emails, web forms, etc. Each of these sources needs to be integrated into one main format. This not only increases processing time but also increases the risk of errors, such as incorrect payment amounts or double invoices, which can lead to late payment penalties (a prime example of the economic consequences is the loss of USD 1.1 trillion on Wall Street in 2010 (Majewski, 2018)). The dispersion of other major mistakes on the accountant's side (according to Bloomberg, Majewski, 2018): saving a file with corporate, financial or tax information to a personal device and corrupting the data (18% of all errors); accidentally deleting a custom Excel formula used to calculate corporate tax data (17% of all errors), overwriting data in the corporate system with numbers calculated outside the program (13% of all errors). Errors can also be on the side of auditors and regulators, although they are less common, their correction is more costly, as they require large system solutions (for example, Bank of America lost USD 7.7 million in 2009). (Majewski, 2018)). The dispersion of the largest errors on the part of auditors and regulators (according to Bloomberg, Majewski, 2018): lack of control over the interpretation of centralized accounting standards, which leads to their distorted interpretation and incorrect entry into the system (31.2% of all errors); premature closure of reporting and reference forms by regulators (12% of all errors); incorrect application of tax rules and other provisions of centralized accounting standards (10% of all errors). Thus, we conclude that accounting errors are the most likely risks in the subject area.

The consequences of information vulnerability are illustrated by IBM research (Cost of a data breach..., 2023) (Figure 2).

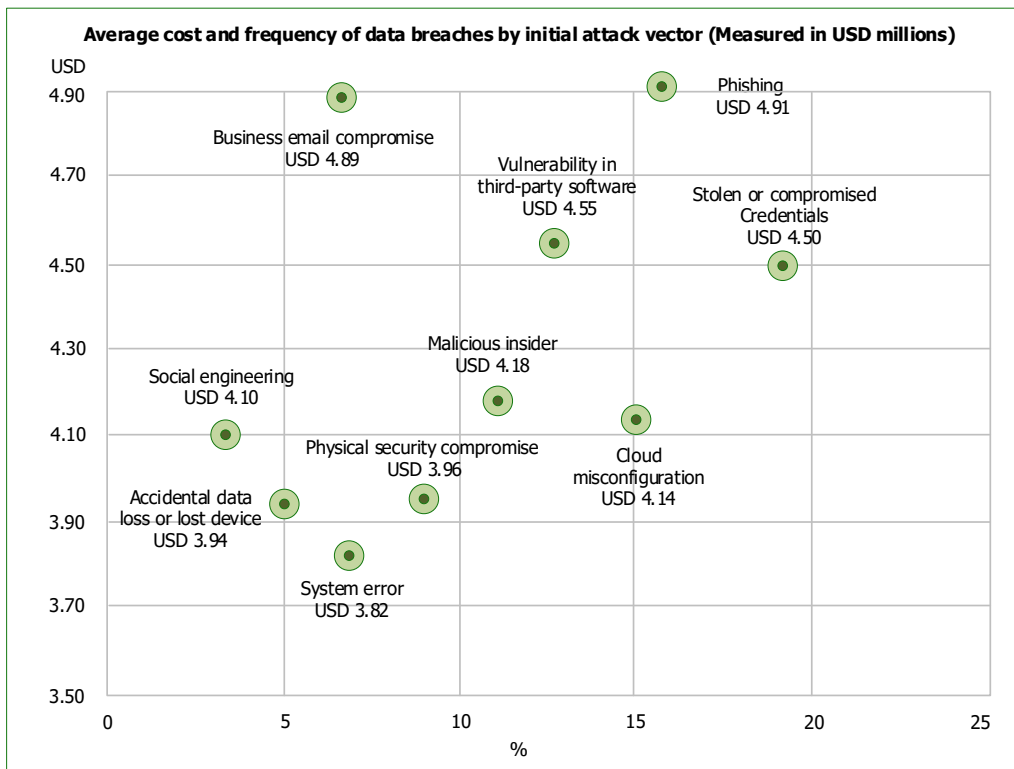


Figure 2. Differentiation of digital threats and vulnerabilities by the level of financial losses in 2022, according to IBM estimates.
(Source: Cost of a data breach..., 2023)

According to the data presented in Figure 2, as a result of information vulnerabilities in 2022, various companies lost more than USD 26.85 million in the context of accounting policy research. THE TOTAL AMOUNT OF LOSSES WAS OVER USD 26.85 MILLION. At the same time, the most frequent threat to information security is the disclosure or compromise of financial information (19.5% of the total threats with an estimated value in monetary terms of USD 4.8 million).

Taking into account the above aspects, we model the most likely risks for the subject area - Figure 3.

According to the above model (Figure 3), the most likely way to develop the risk of an accounting error in a typical organizational and technological scheme for supporting a financial and economic transaction between two counterparties is to impose a fine by the state regulator (red branch), with the probability of such a scenario being $15/65 \times 100\% = 23.1\%$.

In the case of applying the technical capabilities of Blockchain and the corresponding modernization of the organizational and technological scheme of accounting support for a financial and economic transaction between two counterparties (according to the concept of the results of the comparative analysis - Figure 3), the most likely scenario is early detection of an error and its quick elimination without additional financial costs (green line). The probability of this scenario is $24.9/35 \times 100\% = 71.1\%$.

Thus, it has been proven that the use of Blockchain technology will reduce the most common risk of accounting errors by $71.1/23.1 = 3.1$ times.

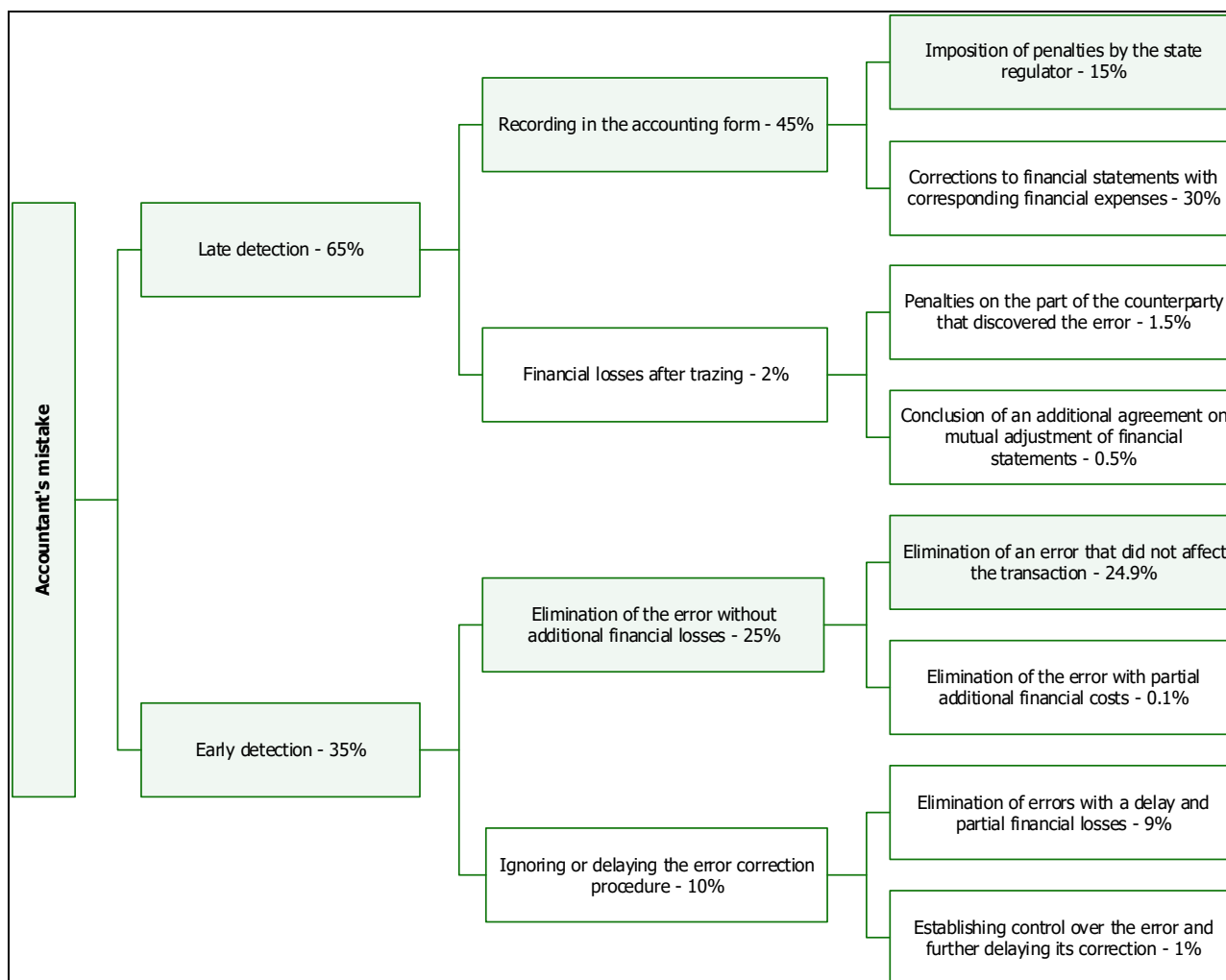


Figure 3. Modelling the risk of error in accounting support of a financial and economic transaction. The red branch is a likely scenario based on a typical organizational and technological scheme of accounting support. Green branch - in the case of using Blockchain technology.

We will perform similar modelling for the information security aspect (Figure 4).

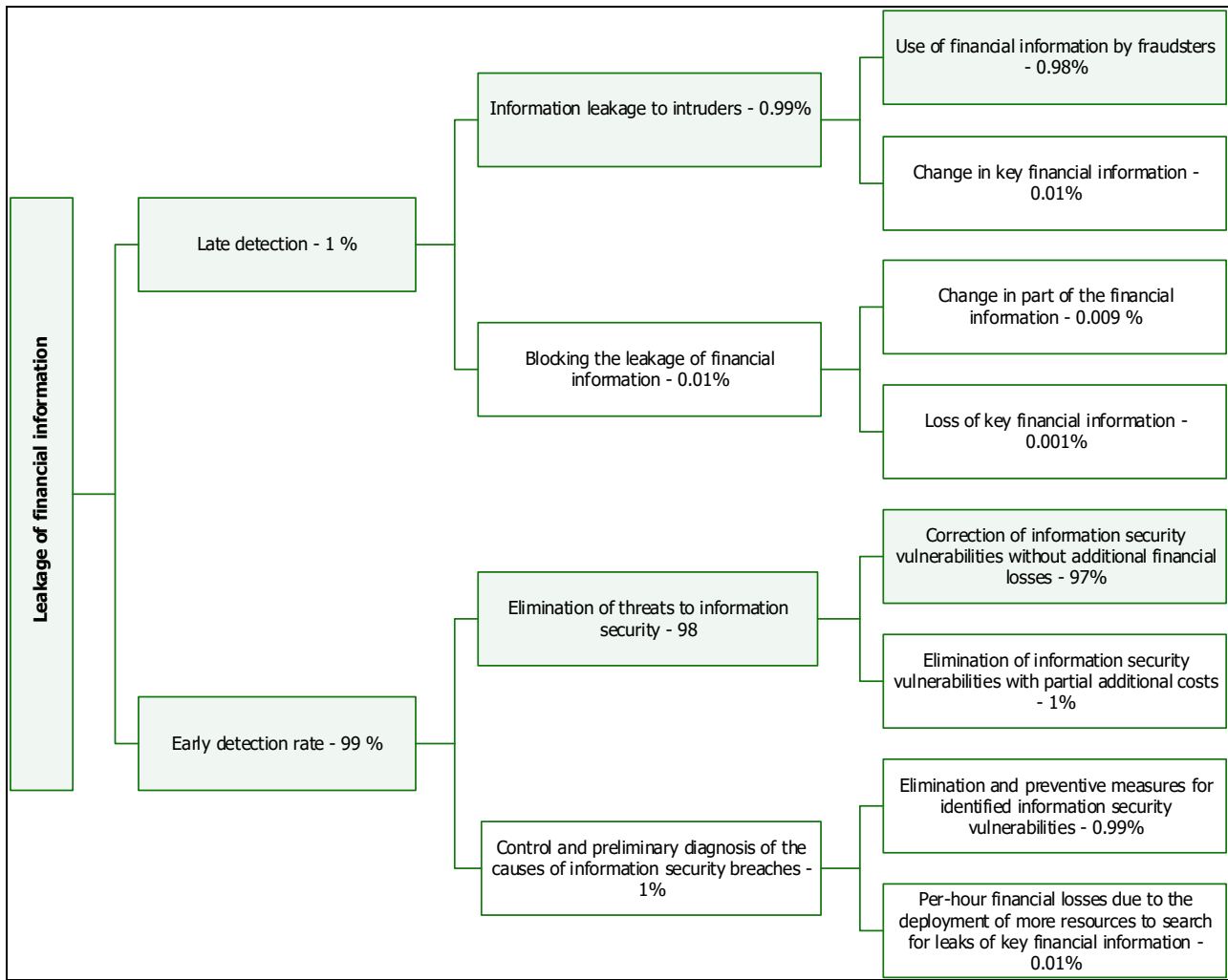


Figure 4. Modelling the risk of an information security vulnerability in accounting support of a financial and economic transaction. The red branch is a likely scenario based on a typical organizational and technological scheme of accounting support. Green branch - in the case of using Blockchain technology.

In this case (Figure 4), under a typical organizational and technological scheme, the scenario of preventing the loss of financial information and its use by intruders is the most likely (red branch) - $0.98/1 \times 100 \% = 0.98\%$.

In the case of using Blockchain technology, the loss of financial information is practically impossible (due to the nature of the technology under study), which results in the probability of preventing the loss of financial information (green branch) being $97/99 \times 100 \% = 97.9\%$.

That is, thanks to Blockchain technology when organizing accounting support for a financial and economic transaction, it is possible to achieve the integrity of information security $97.9/0.98=99.9$ times more efficiently than under a typical scheme (see Figure 1).

Thus, the results of risk-oriented modelling suggest that the use of Blockchain technology in organizational and technological schemes of accounting support for financial and economic transactions and in general in the field of accounting and auditing is thorough and appropriate and allows to significantly optimize the subject area, forming promising opportunities for the global accounting policy system as the corresponding centralized application programs.

Taking into account the above aspects, we modelled the most likely risks for accounting and auditing in the context of using Blockchain technology. According to the model (Figure 3), the most likely risk in a typical organizational and technological scheme is the imposition of a fine by the state regulator for accounting errors, which is 23.1%. However, when using Blockchain technology and modernizing the organizational and technological scheme, the most likely scenario is early detection of an error and its elimination without additional financial costs, with a probability of 71.1%. Thus, the use of Blockchain technology will reduce the most common risk of an accounting error by 3.1 times.

Similar modelling was conducted for the information security aspect (Figure 4). According to a typical scheme, the most likely scenario was to prevent the loss of financial information and its use by intruders (0.98%). However, with the use of Blockchain technology, the loss of financial information becomes virtually impossible, which ensures the probability of preventing loss at the level of 97.9%.

Therefore, the use of Blockchain technology in organizational and technological schemes of accounting support of financial and economic transactions and in the field of accounting and auditing is appropriate and thorough. This allows to significantly optimize the subject area, creating promising opportunities for the global accounting policy system.

DISCUSSION

It should be noted that no similar risk-based modelling system has been used in any research to study the impact of Blockchain technology on accounting and auditing. The above model and calculations are only hypothetical and are based on a logical understanding of the principles of Blockchain technology and the accounting and auditing sphere. In order to obtain accurate and objective results, it is necessary to conduct a detailed scientific study taking into account specific conditions, factors, and real data.

There are a number of specialized works that describe the general concept of risks in the field of accounting and auditing, including those reviewed in this study: Drábková & Pech, 2019; Boisseau-Sierra, Chu & Rajgopal, 2023; Wang et al. However, these works, in comparison with the current study, do not contain information on the impact of the studied Blockchain technology on the identified risk factors.

Also, at the time of the current study, there are no studies containing information on the parametric assessment of the impact of Blockchain on the field of accounting and auditing, but there are a large number of review articles, including those considered in the current study: Shah, Jhanjhi & Laraib, 2023; Yang & Yin, 2023; Alkafaji, Dashtbayaz & Salehi, 2023; Han et al., 2023; Singh, Joshi, & Sharma, 2023; Oladejo, 2023; Singh et al, 2023; Stafie & Grosu, 2023; Peter, & Vukovljak, 2023; Shah, Jhanjhi & Laraib, 2023; Morton & Curran, 2023; Petchenko et al, 2023; Li et al., 2023; Du et al., 2023; Vardia & Singh, 2022; Spanò et al., 2022, which are descriptive and do not fully justify the use of Blockchain to optimize the field of accounting and auditing.

Taking into account the results of risk-based modelling, it is advisable to deploy a further vector of research in the direction of analyzing the financial statements of individual enterprises in order to test the formed concept model.

CONCLUSIONS

Integrating blockchain technology into accounting auditing and financial-commercial and financial-economic analysis can be useful for improving the efficiency and accuracy of these processes. The use of blockchain can provide greater security and transparency, reduce the potential for errors and falsification, and aid in data collection and analysis. However, the implementation of this technology may face challenges, such as a lack of readiness for adoption, high costs, problems with standardization and data protection, legal issues, and slow transaction speeds. Assessing the feasibility of blockchain technology must consider both the benefits and the potential risks and costs in order to make an informed decision.

Despite this, there can be many benefits to using blockchain in accounting auditing and financial and economic analysis. These benefits include:

1. Improved data accuracy and reliability. Blockchain ensures the security and accuracy of the data stored in the system. This can help avoid errors and reduce the risk of abuse.
2. Improved process efficiency. Using blockchain can reduce the time and cost of auditing and analyzing financial activities. This is possible by automating processes and reducing the need for human resources.
3. Reduced storage and processing costs. Using blockchain can reduce the cost of storing and processing data because the technology ensures data security and accuracy.
4. Improved data protection. Blockchain provides data protection through encryption and decentralization. This can help avoid the loss of sensitive information and increase the protection of user data.
5. Ability to conduct audits in real-time. Blockchain can enable real-time auditing, which enables faster detection and resolution of problems.

Consequently, the use of blockchain technology in accounting auditing and financial performance analysis can have many benefits beyond the challenges and problems associated with its implementation.

Subsequent research iterations in this direction should focus on exploring the field of expert opinion and finding practical mechanisms for integrating blockchain technology tools into typical processes and operations of accounting and analysis of financial and economic activities.

Based on the results of risk-based modelling, it was found that the use of Blockchain in the modernized organizational and technological scheme of accounting support for financial and economic transactions based on the results of comparative analysis can reduce the most common risk of accounting errors by 3.1 times and ensure the integrity of information security by 99.9 times better. Accordingly, the results obtained largely substantiate the use of Blockchain in the accounting sector as a systemic optimization solution.

ADDITIONAL INFORMATION

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ІННОВАЦІЙНІ ТЕХНОЛОГІЇ В БУХГАЛТЕРСЬКОМУ ОБЛІКОВІ ТА АУДИТІ: ДО ПИТАННЯ ВИКОРИСТАННЯ ТЕХНОЛОГІЇ БЛОКЧЕЙН

Мета дослідження – надати обґрунтування застосування Blockchain technology в галузі бухгалтерського обліку та аудиту. Основні результати дослідження вказують на потенційні переваги використання технології Blockchain в обліку та аудиті фінансово-економічних транзакцій. Аналіз ризиків показав, що впровадження Blockchain може допомогти знизити ймовірність появи бухгалтерських помилок, а також забезпечити вищий рівень інформаційної безпеки. Застосування Blockchain у бухгалтерському супроводі транзакцій може привести до зменшення штрафів, пов'язаних з обліковими помилками, та більш швидкого виявлення й виправлення помилок без додаткових фінансових витрат. Крім того, технологія Blockchain може практично внеможливити втрату фінансової інформації та її використання зловмисниками. Отримані результати дослідження підкреслюють значимість впровадження Blockchain в організаційно-технологічні схеми бухгалтерського супроводу транзакцій, а також у галузі обліку та аудиту загалом. Впровадження цієї технології може оптимізувати процеси обліку, покращити точність та достовірність фінансової інформації, забезпечити більш ефективний контроль і знизити ризики для економічних суб'єктів. За результатами ризик-орієнтованого моделювання встановлено, що впровадження технології Blockchain в організаційно-технологічні схеми бухгалтерського супроводу фінансово-економічних транзакцій дозволяє знизити ризик бухгалтерської помилки в 3,1 разу та забезпечує значне покращення інформаційної безпеки в 99,9 разу порівняно з традиційними методами. Це свідчить про потенційні переваги використання в бухгалтерській сфері Blockchain як системного оптимізаційного рішення. Отримані результати підкреслюють важливість подальшого дослідження та впровадження Blockchain для покращення якості фінансового обліку, забезпечення надійності та зменшення ризиків у цій сфері.

Ключові слова: блокчейн, бухгалтерія, децентралізація, цифрова економіка, цифровізація

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