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THE APPLICATION OF BLOCKCHAIN TECHNOLOGY IN ACCOUNTING AND AUDITING: EXPERIENCE OF UKRAINE AND KAZAKHSTAN

ABSTRACT

Blockchain technology is widely used in accounting and auditing by powerful global manufacturers. Implementing blockchain in the enterprise increases the efficiency of accounting and auditing processes and system reliability, reducing the likelihood of errors and fraud. Some countries around the world, such as the USA and the United Kingdom, are actively using this technology in accounting and auditing. However, most countries are still in the early stages of implementing blockchain. In Ukraine and Kazakhstan, the modernization of accounting and auditing is gradually gaining momentum. One of the obstacles to the rapid development of blockchain is the lack of understanding of employees regarding the need to implement blockchain technology. The purpose of the study is to reveal the potential of blockchain in accounting and auditing by highlighting its functional features and assessing the opportunities to improve the workflow of accountants and auditors. The article defined the structure of blockchain, its main functions, advantages and disadvantages, compared it with traditional methods of accounting and auditing. The possibility of implementing smart contracts as a blockchain application in enterprises was emphasized and a comparative analysis of the platforms on which they are implemented was carried out. The study identified both positive and negative consequences of the technology's implementation. It is emphasized that blockchain does not guarantee complete protection against fraud, and the occurrence of transaction errors can lead to significant financial losses. Nevertheless, blockchain can significantly improve the functionality of accounting and auditing systems if the rules are followed. Blockchain adoption in enterprises is fully consistent with Ukraine's digital transformation strategy and Kazakhstan's Sustainable Development vision, but it requires significant investment and high-quality staff training to be successful.

Keywords: blockchain, accounting, auditing, workflow, innovative technologies, electronic document

JEL Classification: M15, M41, M42, O14, O33

INTRODUCTION

In recent years, blockchain technology has been increasingly used in a variety of industries. In contrast to traditional document management methods, blockchain offers more efficient ways to invoice, document, process, record, inventory systems and pay businesses. The technology will allow companies to record both sides of a transaction simultaneously in a common ledger in real-time, instead of keeping audited financial transaction records in separate private databases or ledgers. In the future, the need for traditional double-entry bookkeeping may disappear as legal accounting should become fully automated. Blockchain technology has great potential to fundamentally change the accounting and auditing professions. It has the potential to not only make work easier and faster but also to fire off specialist time to focus on more serious matters. Nevertheless, not all accountants understand how blockchain-based accounting works and the opportunities that technology can provide in professional practice.

Ukraine is actively moving towards digital transformation in the areas of the economy, energy, education, etc. Ukraine has introduced digital passports for the first time, the state is the fourth in Europe with a digital driver's license. In February 2021, 94 digitalization projects were launched, which should also affect changes in accounting and

auditing (Volodymyr Zelenskyy Supports of Strategy of Digital Transformation of Ukraine for Coming Years - Official Website of the President of Ukraine, 2022). The martial law has made it difficult, but not impossible, to finally implement the relevant reforms. All the more so, the introduction of digital technologies will help preserve the necessary documentation in digital form and reduce the risk of losing it.

Since Kazakhstan is just beginning a major digital transformation of the economy, many businesses are still using traditional accounting and auditing methods that do not guarantee a high level of protection against errors and fraud. However, the digitalization of production processes is one of the key points of the Sustainable Development concept approved by the government of Kazakhstan (Baygarin, 2022). Thus, the transition to the use of the latest technology is a necessary step for the development of the country (Ostropolska, 2021). This article reveals the essence of blockchain technology in the field of accounting and auditing, identifies its main functions, advantages and disadvantages proves significant advantages over traditional methods. The paper also examines the current state of the digitalization process in Ukraine and the Republic of Kazakhstan and provides recommendations for the implementation of blockchain in the accounting and auditing spheres among Ukrainian and Kazakh enterprises.

LITERATURE REVIEW

The topic of using blockchain in accounting and auditing is covered in many contemporary publications. Schmitz & Leoni (2019) posed the following research question that they addressed in their paper: what are the main themes that emerge from academic research, professional reports, and websites that discuss blockchain technology in the context of accounting and auditing? To answer this question, a review of academic literature, professional reports, and reputable websites was conducted. The results showed that the most discussed topics in academic papers and professional sources are governance, transparency and trust in blockchain, continuous auditing, smart contracts, and the paradigm shift in the role of accountants and auditors. Based on these topics, practical advice is provided for accountants and auditors on how to enhance their skills in the age of blockchain technology and suggestions for upcoming research in accounting and auditing.

Tan & Low (2019) provide a prediction of the transformation of accounting when blockchain is implemented. The paper argues that blockchain technology affects the database mechanism of an accounting information system by digitizing the current paper-based verification process. In a blockchain-based accounting information system, accountants will not be the central authority. They will remain financial statement preparers under regulations and will continue to influence the selection and accreditation of validators. Audit testimony will still need to be collected in order to provide an opinion in a blockchain-based accounting information system. While the digitization of the verification process reduces errors and the cost of confirming and tracking transactions, and the immutability of technology data reduces the likelihood of fraud, a blockchain-based accounting information system alone does not guarantee that financial statements will be fully truthful and fair. The authors believe that reducing errors and fraud will improve audit quality. Using a three-tiered accounting information system architecture, this paper fills a gap in the literature that does not consider how the characteristics of blockchain technology can impact the implementation of a blockchain-based accounting information system with associated implications for the accounting profession.

Demirkan et al. (2020) review the current and potential use of technology in business, particularly in accounting and cybersecurity. The researchers analyzed the literature on topics such as big data in accounting, the use of blockchain in financial security and cybersecurity, in accounting through the use of ledger technology, and as a system for tracking financial irregularities. It is argued that blockchain should be implemented in various aspects of cybersecurity and accounting, such as auditing and general accounting procedures.

Kimani et al. (2020) analyzed the impact of blockchain on accounting, auditing, finance, taxation, banking, and international trade and showed how companies can use blockchain to improve the efficiency of business operations. The authors focus on key drawbacks that managers should keep in mind before implementing blockchain in their organizations.

Maffei et al. (2021) investigated the implications of the adoption and implementation of the technology in accounting and auditing practices and identified the benefits and potential threats, which allowed to identify new and future risks and challenges. Unlike the previously considered sources, this article focuses on the threats and risks that may be caused by its implementation. The study also emphasizes the importance of the professional consciousness and experience of accountants and auditors in comparison with the impersonal and standardized operating system of artificial intelligence provided by the blockchain. The development and proliferation of technology are encouraging professionals to learn new ways of accounting and auditing and rethink traditional.

Desplebin et al. (2021) reviewed the functions of blockchain technology, and the potential transformations of accounting, and determined how its implementation could further impact accountants and auditors. To this end, the authors analyzed the literature and applied a forward-looking approach to the use of this technology in accounting and auditing. The researchers identified 3 main issues regarding the prospects for change in this area: the transformation of accounting methods, changes in accounting and auditing, changes in the work, skills and education of specialists.

Lapin et al. (2022) identified the constituent elements of digitalization in Ukraine, its positive and negative features. Much attention was paid to the sphere of the economy, including the banking sector, the financial market, etc. The authors described the positive effects of the digitalization of Ukraine's economy, encompassing detenification, personnel growth and increased competitiveness of enterprises. Gelmanova et al. (2019) considered the main prerequisites for the development of blockchain technology in Ukraine. The authors highlighted the main advantages of blockchain, which are based on the convenience and optimality of the system, established factors and prerequisites for the further development of cryptocurrencies and blockchain technology in Ukraine and the world.

In the case of the introduction of blockchain technology in organizations of the Republic of Kazakhstan, this area is still underdeveloped in the country. Gelmanova et al. (2019) consider the possibilities of introducing the technology at enterprises on specific examples, proposed the option of creating their own peer-to-peer blockchain system and the principles of its operation. However, the list of works on the application of blockchain in accounting and auditing in Kazakhstan is limited. In addition, some publications do not justify the need to modernize the accounting information system and do not compare the functionality of the traditional accounting system and the one based on the blockchain.

AIMS AND OBJECTIVES

The aim of the study is to determine the role of blockchain in improving accounting and auditing in the example of Ukraine and Kazakhstan. To achieve the result of the study the following tasks are defined. To analyze the structure of blockchain, its main functions, characteristics and advantages. To consider the essence of such a variety of blockchain technology as smart contracts and to highlight the prospects for their implementation in accounting. Examine the problems of blockchain application in Ukraine and Kazakhstan and provide recommendations for their solution for the dissemination of blockchain technology in accounting and auditing in firms operating in all sectors of the economy of Ukraine and the Republic of Kazakhstan.

METHODS

A set of general scientific methods of knowledge was used to conduct the study. In the study of theoretical provisions and the current state of blockchain and its applications in accounting and auditing, the rationale for the use of this technology in enterprises, methods of theoretical analysis, comparison, generalization and synthesis were used. Particular attention was paid to the analysis of the essence of blockchain technology and its comparison with the traditional accounting and auditing system. With the help of these methods, the structure of blockchain and the principle of operation were defined, its advantages over the traditional system, which uses paper and involves third parties to conduct operations, were justified. Through the application of the method of analysis in the study of smart contracts as a blockchain application, their main functions and prospects for use in auditing and accounting were studied. The comparison of blockchain platforms such as Ethereum, NXT and Hyperledger Fabric allowed to understand the distinctive features of different types of blockchain and their application in practice. The use of methods of generalization and synthesis allowed to really characterize the current state of development of information technology in Ukraine and Kazakhstan, to provide generalizing recommendations for the introduction of blockchain in enterprises.

RESULTS

To date, three methods of document management are used: classical (paper-based), electronic mail, and cloud storage. The first method has a high cost and low handling speed. Requires the help of a third party to carry out a particular operation (mail, courier service). The second method is suitable only for the initial discussion of the terms of any contract because later the document approved by both parties must be transferred to paper and signed in a classical way or an executive summary of the document with the help of an external program. The third way is vulnerable and unreliable. The presence of a centralized server makes it unprotected and unstable from system errors and hacker attacks. If in blockchain

technology each block has its own “password”, in this case, it is enough to own the key from the central server (Kwilinski, 2019).

According to Muravskiy et al. (2021), 2018 saw an increase in research on ways to use blockchain technology in accounting and auditing. It peaked in 2021, driven by significant public attention to cryptocurrency assets. Investment in blockchain technology grew from about USD 4.5 billion to USD 6.8 billion in 2021 and should reach USD 24 billion in 2025. The number of transactions using blockchain to structure information is growing in every geographic region. The leaders in blockchain technology adoption are in the Far East and China and Europe, as evidenced by the national affiliation of researchers in the use of blockchain in accounting and auditing.

Numerous international corporations are already using blockchain technology, including in accounting and auditing. As of 2022, Meta, Adobe, Verizon, Nvidia, Apple, Verizon, Tesla, Walmart, Amazon, Paypal, Visa, Mastercard, etc. are using this technology. (Makarov, 2022). Reliable and up-to-date accounting will make the auditing process transparent and greatly reduce the time it takes. Instead of checking huge volumes of daily transactions, employees will be able to focus more on solving complex and controversial issues. Thus, the automation of processes will not lead to the disappearance of professions such as auditor or accountant, but to an evolution in their professional activities. Through blockchain technology, it becomes possible to create records, and process and store financial transactions and information in a radically new way. Companies such as Factom, Libra and Verady are currently developing blockchain solutions that can be applied to the auditing environment (Abreu et al., 2018).

According to Finances Online (2021), the U.S. was expected to spend USD 4.2 billion in 2022, making it the largest regional investor in blockchain solutions. Western Europe (USD 2.9 billion), the People's Republic of China (USD 1.4 billion), Asia-Pacific and Japan (USD 0.75 billion), the Middle East and Africa (USD 0.5 billion) and other countries (USD 1, 9 billion) (Figure 1).

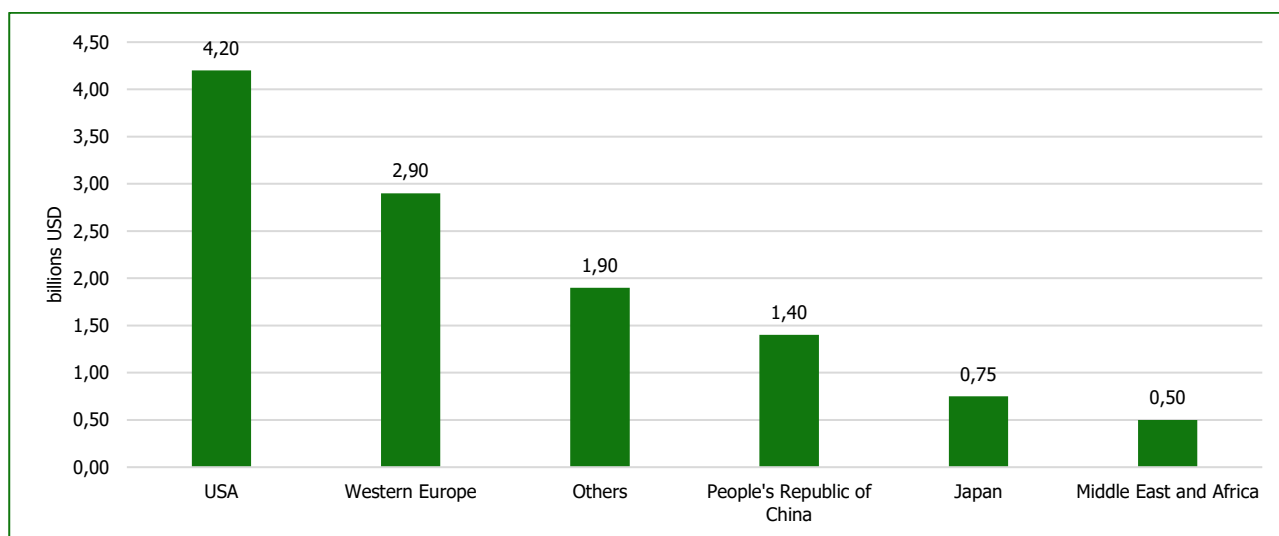


Figure 1. Top Blockchain Spenders by Country or Region. (Source: 51 Critical Blockchain Statistics: 2021 Data Analysis & Market Share, 2021)

Blockchain is a public ledger that records and stores groups of transactions or events in a chain-like data structure. A block is a packet of information ordered into a chain according to the timing of a transaction. Each successive new block is linked to the previous block and contains some data set containing encrypted information about the previous block. The encryption process is called hashing. The structure of the blockchain is designed so that any information entered into the chain cannot be changed without violating the integrity of the overall chain. When a new entry is made, the system informs all users. This makes the process transparent and resilient to the outside world and eliminates the need for a central authority to oversee the reliability of the system. All information is stored on users' computers. Using Bitcoin as an example, information about completed transactions sent by nodes is recorded in each block of data. This information includes the identity of the sender and recipient, the amount and time of the transaction, etc. Each block also contains an identifier, a timestamp, and a relationship to the previous block. These data blocks are combined into a chain that records in real-time all the information about the transactions performed throughout the network. If they have been validated and added to the chain, the blocks are no longer undoable and difficult to work around. This principle of operation ensures the transparency and reliability of the system (Valdeolmillos et al., 2019).

The main characteristics of blockchain can include decentralization, openness, traceability, protection against third-party interference, data security and reliability, and anonymity. The system uses peer-to-peer (P2P) network technology, so there is no centralized control centre. Each node in the network has equal status, and all nodes record and store data about the transactions performed. Thus, the reliability of the system is increased. The openness of the blockchain system stems from the fact that anyone can request access to information through the hash value of the blockchain header. The information of the system is not stored in one place but is distributed over a number of computers. This ensures the security of the system and minimizes the risk of data leakage. To make changes to the information must be written to the next block, but other users must confirm this operation. Traceability refers to the fact that records added to the blockchain are permanently stored in the system, and each transaction record includes data about the traders. It is possible to fully trace the transmission path of a transaction object. Because blockchain technology uses asymmetric cryptography to encrypt data and a consensus algorithm to protect against external attacks, it provides security and the inability to tamper with information. Notification schemes can be built into blockchain to detect suspicious transactions in a timely manner or to monitor an organization's financial health and help decision-makers, as well as in the development of new control mechanisms (Wu & Tran, 2018).

Special attention should be paid to blockchain applications such as smart contracts. Based on blockchain technology, a computer protocol has been created that allows an agreement to be made and controlled by mathematical algorithms. This development was first proposed in the 1990s by Nick Szabo. It can act as a constructor, allowing the creation of smart contracts. A new smart contract is placed on the blockchain by calling the constructor function through a transaction. The sender of this request becomes the owner of the smart contract. Another example is the self-destruct function. Usually, only the owner of a smart contract can destroy the contract by calling this function. There is also a function for calling other smart contracts. Each smart contract includes states. States refer to variables that store certain data or the address where the smart contract is located (the owner's wallet address). Two types of states are distinguished: persistent states, which can never be changed, and writeable states, which store states in the blockchain. They are pieces of code that can read information or change states (Khan et al., 2021). When entering into a smart contract, each party spells out the terms of the transaction, the penalties for non-performance, and their digital signatures. The smart contract determines whether the conditions are met and decides whether to close the deal, fine the participants, or close access to the assets. This type of contract, consisting of transactions, is stored, duplicated and updated in distributed blockchains. With conventional contracts, they must be centrally executed by a trusted third party, resulting in long execution times and additional costs. Companies adopting blockchain with smart contracts can improve compliance and risk management. For example, smart contracts can facilitate organizations' compliance with different laws and regulations. They can be developed and deployed on blockchain platforms such as Ethereum, NXT, and Hyperledger Fabric (Liu et al., 2019).

Ethereum is the first and now the most popular blockchain platform for developing smart contracts. It supports advanced and personalized smart contracts using a virtual machine called the Ethereum Virtual Machine (EVM). The Solidity programming language with Turing completeness is used to write smart contracts, and the contract code is compiled into EVM byte code and deployed in the blockchain for execution. An Ethereum smart contract account consists of its code, the contract address, the state consisting of private storage and the balance in virtual coins (ethers). Smart contracts contain ethers as a form of cryptocurrency as a balance. Ethers can be sent to other contracts to fulfil a smart contract. This is a very responsible task, as any type of vulnerability can cause economic costs. As a reminder, smart contracts cannot be changed once placed on the blockchain, so developers must consider security vulnerabilities when coding (Kushwaha et al., 2022).

NXT is an open-source blockchain platform that is based entirely on the consensus protocol. It includes a collection of active smart contracts. However, it is not complete according to Turing, meaning that only existing templates can be used and personalized smart contracts cannot be deployed (Zhao, 2022; Bulkot, 2021). In the case of Hyperledger Fabric, the platform is not public. It is only allowed to a group of business-related organizations and can join it through a membership provider. Its network is built from peer-to-peer networks owned by those organizations. The Hyperledger Fabric architecture accommodates the diversity of uses in enterprises with components that can be connected and used (Chen et al., 2018). Ethereum and Hyperledger Fabric smart contracts differ in many ways. For example, Hyperledger Fabric supports programming languages such as Go, Java, and Javascript. To execute a transaction in Ethereum, the contract code is included in a transaction that is distributed in a peer-to-peer network, and the participant who receives the transaction can execute it on their local virtual machine. In Hyperledger Fabric, the transaction is executed and signed only by certain peer participants. Upon receiving a transaction request, each peer independently executes the transaction by calling the chain code to which the transaction refers (Kushwaha et al., 2022).

A comparison of conducting a funds transfer transaction in accounting and blockchain systems is as follows. In a traditional remittance system, where the sender initiates a request to transfer funds to an intermediary (in this case, a bank). The

bank then verifies the legitimacy of the request, the sufficiency of the funds, and the limit of the transaction. If the bank approves the request, the money will be transferred from the sender to the recipient. In doing so, the sender's bank will record the transaction in its accounting and notify the sender. Finally, the beneficiary's bank records the money transfer in its accounting and notifies the beneficiary. It should be noted that the involvement of intermediaries may lead to delays in the transaction, as well as errors and discrepancies in the registers of the parties. Part (b) depicts the execution of the same transaction using a blockchain. In this system, a person wishing to transfer funds creates an encrypted message. This message contains information about the amount and the recipient's network address and then spreads to the entire network, where other users compare the amount with the sender's last balance, recorded in the blockchain, and verify the validity of the message. If the message is validated, the transaction is executed. A newly formed block containing the transaction is added to the end of the chain. Unlike a traditional system, no financial intermediary is involved in this transaction to verify or approve the transaction, which is called decentralization.

Blockchain has a proven track record in dealing with financial data. It has the potential to revolutionize the accounting profession and reshape the business system. Some experts believe that the adoption of technology in accounting and auditing will jeopardize jobs and negatively impact cybersecurity, financial planning, and analysis (Odintsova & Rura, 2018). On the other hand, the basic functions of accountants and auditors are changing from the usual filling out documentation and entering data about transactions into an information system to forming before making their own management decisions, which requires a detailed assessment of all factors affecting the situation in each individual case (Bayev et al., 2020).

Accountants will be able to perform analytical procedures and data verification in real-time, join a private network for auditing and examining information, reduce the time for entering data into the information base, recording events and more time can devote to preparing their own professional judgments, interpretation of the economic content of transactions, the correctness of their reflection in the accounting and reporting. For this, we need to increase the qualifications of accountants. The accountant must become not just an accounting employee, but also a professional analyst who thoroughly understands the economic processes of the organization (Liu et al., 2019).

To avoid storing separate transaction records based on receipts, companies can record them directly in a unified blockchain register, thus creating an interconnected system of records. Note that all records are distributed and cryptographically protected, with little chance of being destroyed or manipulated to hide activity. In accounting, blockchain reduces the number of errors, performs accounting functions automatically, and increases the efficiency of the accountant, which in the future will reduce the cost of accounting and verification of its correctness. To summarize, we can highlight the main benefits of blockchain technology in accounting (Table 1).

Table 1: Advantages of using blockchain in accounting. (Source: Kwilinski, 2019)

Aspect	Expected results from the implementation of Blockchain
Organizational-managerial	accelerating the obtaining of information for making effective decisions; flexible and responsive response to changes in the external and internal environment; Providing users with complete, truthful and unbiased information to maximize the objectivity of their decisions
Economical	cost savings in obtaining information; reduction of expenses on the organization of bookkeeping, saving on the fund of labour accountants; saving on software for accounting
Professional	formalization of IT control to ensure transparency, efficiency, and accounting efficiency; providing reasonable assurance that the financial statements as a whole do not contain material distortions; expansion of the scope and tasks of the use of accounting information
Qualitative	provides high-quality accounting, control, taxation and law
Technological	automation and simplification of accounting and control; synchronization of accounting records; Flexible communications user architecture; safe operation and reliable protection against loss of information and unauthorized interference

In auditing, blockchain can potentially be useful in auditing transactions. Transparency is a key characteristic in this case. All approved users, including those outside the organization, can see transactions. This will not only lead to less work for auditors (sampling and verifying transactions) but also allow them to focus more attention on other transaction monitoring tools. Automating audits will eliminate the need for paper documents. They will be able to verify key data underlying financial statements, reduce costs and time, and financial accounting compliance checks can be performed much more efficiently. With smart contracts, many audit functions can be automated and the time required for the auditor to review records can be reduced (Bonsón & Bednárová, 2019).

The digitalization of the economy is fully consistent with the goals of Sustainable Development (Baygarin, 2022). Ukraine and Kazakhstan respond to global trends and strengthen the work on the digital transformation of industrial entities,

supporting them in the development of innovations that affect the economic production performance, reliability, security, and consistency with the legislative environmental norms. But there are barriers to the adoption of the latest technologies that hinder the digital transformation of enterprises. These are caused by limited cybersecurity, incompatible access, risk of data leakage, noncompliance with digital standards and regulations, limited suppliers of necessary software, low IT competence of employees, lack of financial resources for investment, and sufficient infrastructure Yaroshchuk & Bielova (2021) note that one of the main obstacles to the use of blockchain technology in accounting is that the cost of implementing blockchain in the accounting system is quite high since the relevant platforms require the creation of a distributed network of computers. That is, significant material and energy costs are required, and each computer in the network must contain a lot of memory to store the entire database. For Ukrainian enterprises, such aspects of accounting and analytical support of management as evaluation of consequences of military actions, development of corresponding documentation system, restoration of lost documentation, accounting of assets should be improved. In the analytical component of the management of organizations, promising areas are the analysis of the value of the enterprise, material and non-material damage caused, competitive stability, economic security, and the probability of bankruptcy (Horai & Svirko, 2022). The digitalization of the accounting and auditing spheres will preserve and provide access to it. It also requires improving the qualifications of accountants and auditors, which directly affects the quality of performance.

Supporting the digitalization of the economy by legislative acts has a significant impact on the further development of the country. It should be noted that the following legal acts have been adopted in Ukraine. First, the Concept of the development of the digital economy and society of Ukraine for 2018-2020 was approved by the decree of the Cabinet of Ministers of Ukraine from 17.01.2018 No 67-p. This document outlines the basics of digitalization of non-cash payments, public administration, and harmonization with European and global scientific initiatives. Secondly, approved by the Cabinet of Ministers of Ukraine from 03.03.2021 No 167-p of the Concept of development of digital competencies and approval of the plan of measures for its implementation. The emphasis is placed on improving the quality of training of workers to enable the modernization of the country's economy in accordance with modern requirements (Kamyshanskyi, 2022). Thus, in the case of Kazakhstan, it is important to modernize the regulatory system in accordance with modern requirements.

Also, it is necessary to improve educational programs for analysts who clearly understand the principles of production, the tasks that need to be solved and the correct formation of tasks. The speed of digitalization is influenced by the scale and specificity of the enterprise, industry affiliation, the work of individual structural units and the coherence of their interaction (Aubakirova & Isataeva, 2021). It is important for enterprises to calculate the risk of digital transformation, justify the effectiveness of the implemented projects, and the safety of the implemented tools. It is important to remember that the goals of digitalization are not only to directly increase income but also to provide all necessary, properly structured, prompt, complete and reliable information to all major stakeholders in the process. To activate the digital modification of all structures, it is not enough to carry out activities that promote specific enterprises or projects, instructive coercion of the enterprise, as this will only lead to the imitation of the desired changes. Systemic actions are needed to ensure the formation of a favourable business climate, tax incentives to improve the efficiency of technological modernization and quality corporate governance, to increase investment in staff competence, using relevant digital technologies. Blockchain technology fully meets all the necessary criteria. Its implementation can significantly improve the efficiency and cost-effectiveness of operations in enterprises. It requires significant efforts and investments, but such a step is necessary for the further development of states. It should be noted that the digitalization of accounting and auditing in the cases of both countries is accompanied by the emergence of new threats and risks both for businesses and their partners and clients. This is due to the potential for violations of intellectual property rights, cybersecurity, and the protection of information, ensuring its relevance and accuracy (Pilevych, 2019).

The uses of blockchain technology are quite broad and all of them are fully or partially related to the accounting and auditing system (Figure 2). According to forecasts by Pricewaterhouse Coopers, by 2025 investments in technology will reach USD 25 billion. In the scenario of the digital economy in Ukraine, the share of the digital economy in GDP may reach 65% (in other countries in the world - 50-60%), and Ukraine has the opportunity to become a European leader in innovation and new technologies (Balaziuk & Pilawiec, 2022). As for Kazakhstan, experts expect that by 2027 10% of Kazakhstan's GDP will be stored in blockchain networks. By that period, 10% of all global GDP will be blockchain-based. And in Kazakhstan, given the interest of public and private companies in this technology, these figures should be at the level of the global (Mikshina & Iskakova, 2021).

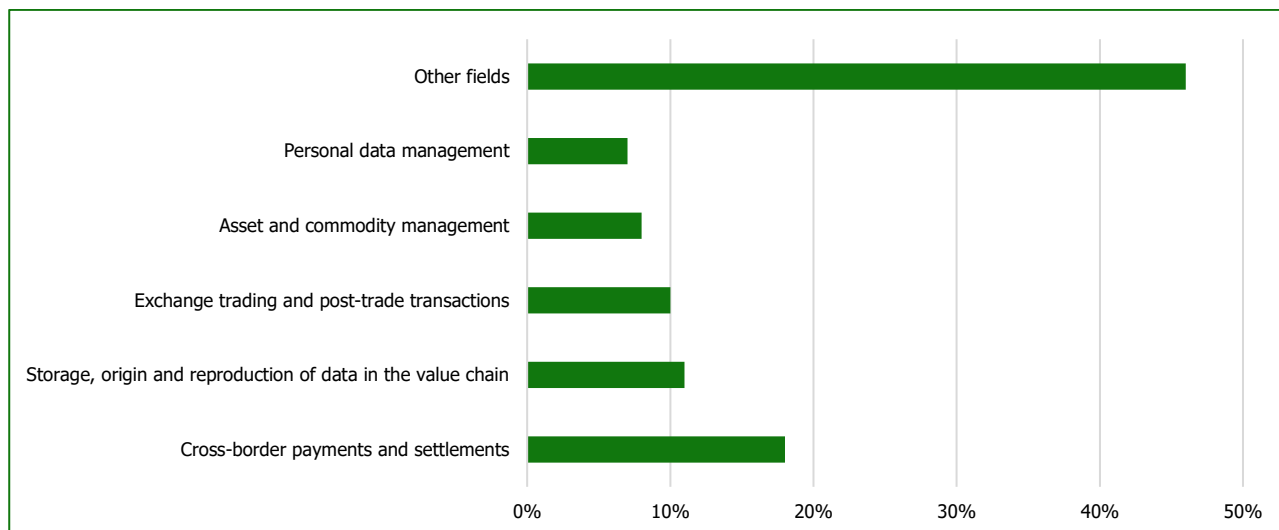


Figure 2. Areas of application of blockchain technology in Ukraine. (Source: Balaziuk & Pilawiec, 2022)

It should be noted that Ukraine has seen rapid growth in funding for this technology (Figure 3). The demand for blockchain startups in the financial markets demonstrates the investment appeal (Verheliuk, 2022).

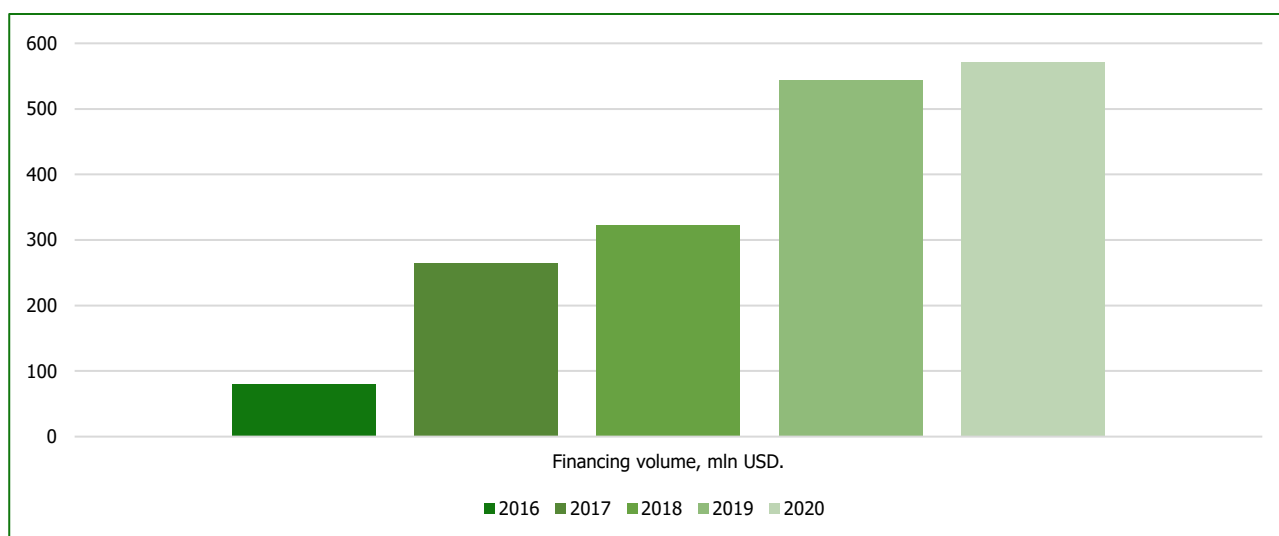


Figure 3. The volume of funding for blockchain startup companies in Ukraine in 2016-2020. (Source: Verheliuk, 2022).

Blockchain technology opens up great opportunities that can significantly improve the country's economic sector. Since Ukraine and Kazakhstan are still at the stage of digital development, it is necessary to pay attention to all features of the digitalization process, taking into account both positive and negative aspects (Figure 4). Blockchain has the potential to fundamentally change the economies of countries, increase the efficiency and security of financial transactions.

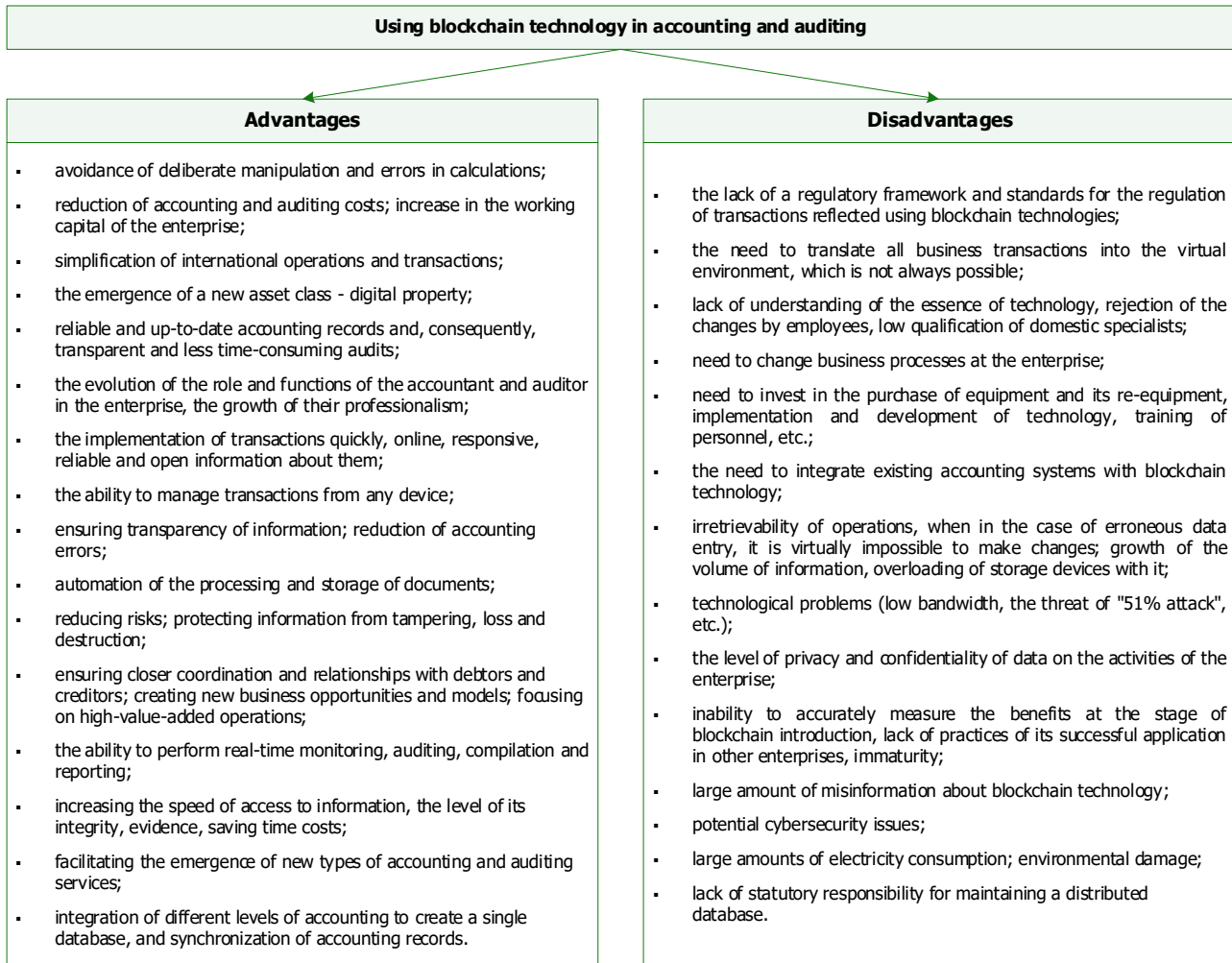


Figure 4. Advantages and disadvantages of using blockchain technology for accounting and auditing. (Source: Popivnyak et al., 2019)

DISCUSSION

To make a comprehensive case for the use of blockchain technology in accounting and auditing, it is important to consider the following questions. Is it appropriate to completely replace the traditional accounting system with blockchain, or should they be used simultaneously? What are the obstacles that could slow down the process of technology adoption? What disadvantages are inherent in blockchain? Molina-Jimenez et al. (2018) believe that blockchain technology is a promising platform for implementing smart contracts. But there is a large class of applications where blockchain is not suitable because of inadequate performance, scalability, consistency and cost. In this paper, the authors explain that in some situations, the centralized approach is a better alternative because of its simplicity, scalability and performance. The researchers suggest that in applications where decentralization and transparency are important, developers can profitably combine this classical approach and blockchain in hybrid solutions, where some operations are performed by executors hosted on the blockchain and the rest by trusted third parties.

Fuller & Markelevich (2019) analyzed the factors of data security and privacy, technology adoption and implementation, and some considerations specifically for accounting and auditing. The authors of the article believe that in its current form, blockchain may not meet the unique needs of an accounting information system. While blockchain can provide many useful functions, especially in the area of data reliability and auditing financial statements, several factors have been identified that have cast doubt on the possibility of large-scale integration of the technology into the accounting function. The main obstacle is the cost of the technology. Although significant investments have been made in the development of blockchain and its business applications, the authors believe that the widespread use of the technology is not yet well reasoned. The researchers also expressed concern about whether blockchain can address risks related to data security and privacy. Addressing these issues will be a minimum requirement for widespread acceptance by companies and their accountants.

Pedersen et al. (2019) provided a step-by-step decision path for executives to follow when deciding to introduce blockchain into their organizations. The researchers cited compelling reasons for using blockchain in accounting. Using a shipping company as an example, it was proven that the cost of developing and implementing blockchain into the system would be significantly lower than the fees and costs of one of the delays in customs clearance of a commonly encountered shipment. In addition, unlike this study, the paper describes three types of blockchain and recommends how to implement each in a specific case. The first is the open public blockchain, which is an open network that anyone can join (e.g. Bitcoin and Ethereum). In this type, all users can read, write and verify transactions, so this type can replace the role of the entrusted third party. A permissioned public blockchain is a closed network in which only verified and trusted nodes (e.g. Hyperledger Fabric, Multichain, Eris) can participate. All participants can view data, but only authorized users can validate transactions. Private blockchain, a closed network that allows only authorized users to read, send and confirm transactions, is allowed (examples include Hyperledger Fabric and Corda). The same blockchain application can operate in multiple types, like Hyperledger Fabric. It can be used to provide an authorized public or authorized private blockchain.

The goal of Bonsón & Bednárová (2019) was to provide an overview of this technology and the scope of accounting transformation potentials. The authors identified unresolved issues in blockchain technology: such as scalability, flexibility, proper architecture, and cybersecurity. The researchers noted that consensus among regulators, auditors and others is needed to fully integrate blockchain into a real-world accounting system. Nevertheless, the paper confirms the high potential of the technology to improve the quality of information exchange and accounting.

This paper does not fully reflect the disadvantages of blockchain as a technology, but it does describe the main obstacles that Ukrainian and Kazakh companies may face in its implementation. Such a move is important for the development of Ukraine and Kazakhstan's economies, but it is important to remember that such a transition requires significant effort and investment.

CONCLUSIONS

Blockchain technology records and stores assets, liabilities, and transactions, and enables cash flow and account reconciliation. It is based on accounting, which is an integral part of accounting activities. Currently, accounting functions are done mostly on paper in order to meet regulatory requirements. It can be gradually integrated with typical accounting procedures, from ensuring the integrity of records to fully traceable audit journals. In the future, the audit process can become fully automated. Since the vast majority of Ukrainian and Kazakh companies are still using traditional accounting and auditing methods at this time, the efficiency and security level of these processes is low. The digitalization of the Ukrainian economy is of particular importance at this time, because storing documents in an electronic format will help save the necessary data of companies. Assessing the world practice, in the field of accounting and auditing, the most rational solution is a gradual transition to the use of blockchain technology. This requires significant investment at the state level and it is important to conduct proper professional development for accountants and auditors. Blockchain does not completely eliminate errors and cannot guarantee absolute security, but it is a good alternative to classic document management. In future studies, attention should be paid to the ways of cooperation of Ukrainian and Kazakh enterprises for mutual development and exchange of experience in the implementation of blockchain in accounting and auditing.

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ЗАСТОСУВАННЯ ТЕХНОЛОГІЇ БЛОКЧЕЙН У БУХГАЛТЕРСЬКОМУ ОБЛІКУ ТА АУДИТІ: ДОСВІД УКРАЇНИ ТА КАЗАХСТАНУ

Технологію блокчейн широко використовують у бухгалтерському обліку та аудиті потужні світові виробники. Упровадження блокчейну на підприємстві підвищує ефективність процесів обліку й аудиту та надійність системи, зменшує ймовірність помилок і ризики шахрайства. Деякі країни світу, такі, як, наприклад, США та Великобританія, активно застосовують цю технологію в сферах обліку та аудиту. Проте більшість держав досі перебувають на початковому етапі впровадження блокчейну. В Україні та Казахстані модернізація бухгалтерського обліку та аудиту поступово набирає обертів. Однією з перешкод стрімкого розвитку блокчейну є незрозуміння працівниками необхідності впровадження технології блокчейн. Метою дослідження є розкриття потенціалу блокчейну в бухгалтерському обліку й аудиті шляхом висвітлення його функціональних особливостей та оцінки можливостей удосконалення робочого процесу бухгалтерів і аудиторів. У статті визначено структуру блокчейну, його основні функції, переваги та недоліки, проведено порівняння з традиційними методами ведення обліку й аудиту. Наголошено на можливості імплементації смарт-контрактів як додатка блокчейну на підприємствах і проведено порівняльний аналіз платформ, на яких вони реалізуються. У результаті дослідження визначені позитивні й негативні наслідки впровадження технології. Акцентовано, що блокчейн не гарантує повного захисту від шахрайства, а виникнення помилок при проведенні операцій може призвести до значних фінансових утрат. Зазначено, що при дотриманні всіх правил блокчейн

у значній мірі може покращити функціональність систем обліку та аудиту. Упровадження блокчейну на підприємствах повністю відповідає стратегії цифрової трансформації України та концепції Сталого розвитку Казахстану, однак для успішної реалізації цього процесу необхідні значні інвестиції та якісна підготовка персоналу.

Ключові слова: блокчейн, бухгалтерський облік, аудит, документообіг, інноваційні технології, електронний документ

JEL Класифікація: M15, M41, M42, O14, O33