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BLOCKCHAIN AS A POWERFUL TOOL IN THE ACCOUNTING AND CONTROL ENVIRONMENT

Abstract. The use of various electronic gadgets and Internet communication has accelerated the company development in various areas of its activities, including in terms of accounting.

The tools of accounting and the peculiarity of blockchain technologies use in the field of accounting for the increase of its efficiency and errors prevention are considered in the article. In addition to this, the structure of these technologies, the basic principles of work are described, and also advantages and lacks are analyzed.

It is given to determine the possibility of using companies that use the locking system in the accounting system. Blockchain technology is known and especially important. In recent years, it has proven its effectiveness in increasing the profits of companies that use it. This technology allows to significantly reduce the costs of companies, especially those that are participants in the stock market, and maintain high stability and strengthening of market positions. You can use it to reduce data processing resources and increase the number of information flows.

Companies that use the blockchain system in the accounting field are revealed. One of the leading companies that uses this technology in Ukraine is Nexia DK. The advantage of using blockchain technology is that it allows a company to record both sides of a transaction simultaneously in a shared real-time ledger, rather than simply storing verified records of financial transactions in separate privately created databases or ledgers.

Blockchain technology is also used by the international company Nestle in the field of trade, through which retailers, logistics companies and manufacturers can track goods as they move along their supply chain.

***Keywords*:** digital economy, blockchain, automation, artificial intelligence, accounting and control.

JEL Classification M41, M42, O33

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БЛОКЧЕЙН — ПОТУЖНИЙ ІНСТРУМЕНТ В ОБЛІКОВО-КОНТРОЛЬНОМУ СЕРЕДОВИЩІ

Анотація. Використання різноманітних електронних ґаджетів та Інтернет-зв'язку дозволили пришвидшити процеси розвитку компанії в різних сферах її діяльності, у тому числі й у розрізі бухгалтерського обліку.

Розглянуто інструменти цифрових технологій, що використовуються у сфері бухгалтерського обліку, і розкрито особливість застосування блокчейн-технологій у сфері бухгалтерського обліку для підвищення його ефективності та запобігання помилкам. Описано також структуру цих технологій, основні принципи роботи, а також проаналізовано переваги і недоліки.

Наведено для наочності приклади компаній, які використовують систему блокчейн у бухгалтерській сфері. Технологія блокчейн є відомою і найбільш прибутковою. Вона за останні роки підтверджує свою ефективність за рахунок зростання прибутку компаній, які її використовують. Ця технологія дає змогу значно знизити витрати компаній, особливо тих, що є учасниками фондового ринку, і забезпечує високу стабільність та закріплення позицій на ринку. З її допомогою можна знизити ресурси для обробки даних і збільшити обсяги потоків інформації.

Однією з провідних компаній, яка використовує цю технологію в Україні, є Nexia DK. Перевагою застосування технології блокчейн є те, що вона дозволяє компанії записувати обидві частини трансакції одночасно у спільній книзі в реальному часі, а не просто зберігати звірені записи фінансових операцій в окремих приватно створених базах даних чи книгах обліку.

Також технологію блокчейн використовує міжнародна компанія Nestle у сфері торгівлі, за допомогою якої роздрібні торговці, логістичні компанії та виробники можуть відстежувати товари, коли вони рухаються по своєму ланцюжку поставок.

***Ключові слова*:** цифрова економіка, блокчейн, автоматизація, штучний інтелект, бухгалтерський облік і контроль.

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Introduction. In the era of the fourth industrial revolution, the development of «smart» technologies is rapid. These trends have not escaped the economic sphere, where the activities of economic entities are characterized by global automation of processes, the introduction of new modern tools for digitization of business operations, which transform enterprises to increase flexibility, adapt to market requirements, quality, safety and efficiency. In addition, the use of the latest technologies is a way to create new business opportunities, gain undeniable competitive advantages.

Research analysis and problem statement. Understanding the continuity of integration of IT tools and technologies in accounting, digitalization of socio-economic relations causes a significant interest of scientists in the theoretical foundations and practical aspects of these processes. In particular, Kancedal N. A. [1], Popovich M. S. [2], Kraus N. M., Goloborodko O. P. [3], Plaksienko V. Ya., Nazarenko I. M. [4], Kloba L. G. [5] raise the problem of modernization of accounting processes in various aspects. However, most scientific publications relate to certain

areas of transformation, modernization of methodology and practice of digital accounting and control environment.

It should be noted that most authors agree that accounting is waiting for changes in the direction of modernization of both the general theoretical and categorical apparatus, and specific accounting practices. Scientists acknowledge that blockchain technologies and artificial intelligence tools will be the catalyst for the evolution of accounting processes. To gain a deeper understanding of what accounting transformations await us in the future, it is necessary to summarize the existing changes in the theory and practice of accounting.

Research results. Of course, the formation and development of the digital economy is a complex multifaceted and time-consuming process, and the problem of creating and implementing digital critical technologies is fundamental for Ukraine today. Nevertheless, there are positive changes in this area, although not deep enough. The main purpose of modernization of Ukraine's economy in the direction of digital development is to increase the competitiveness of the national economy in the world market. Digital technologies, applications, etc. are tools to achieve goals related to various areas of human life and the country. *Fig. 1* shows the main tools of digital technology [6].

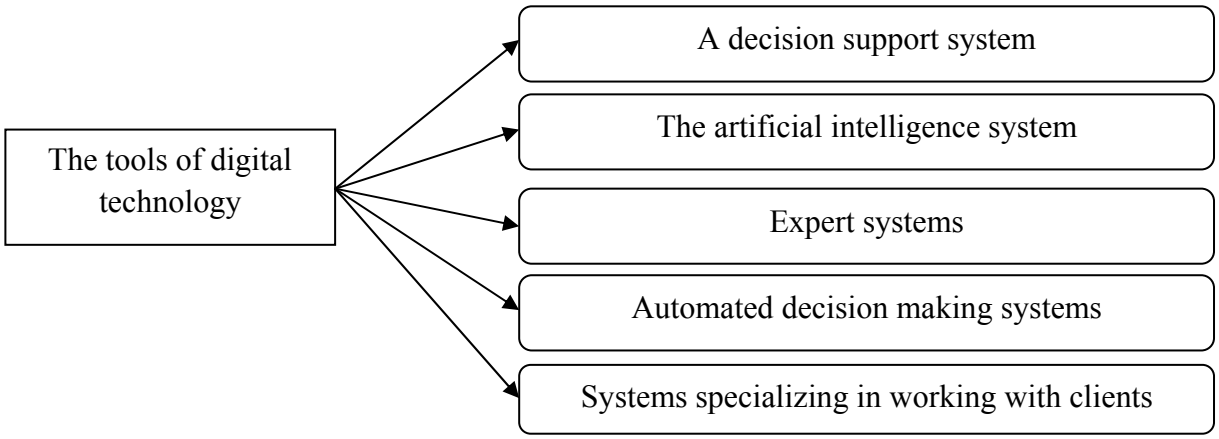

Fig. 1. **The main tools of digital technology**

The artificial intelligence system is used in various spheres of life, however, it has a significant impact on the world of accounting. With the help of an artificial intelligence system, companies will remain competitive. Artificial intelligence will help the accountant to be more productive and efficient in his work. Adding artificial intelligence to accounting transactions will improve the quality of work, as it will help reduce the number of errors.

A decision support system (DSS) is an interactive computer system designed to support various decision-making activities on poorly structured or unstructured issues. Mainly such systems exist in the activities of middle managers. Interest in DSS as a promising field of computer technology and tools of the work efficiency improvement in the field of economic management is constantly growing. In many countries, the implementation of this system has become a fast-growing area of business.

Decision-making technologies based on automated management information systems are divided into:

- reporting systems — provide managers with the information they need for daily decision-making. They perform and draw up various types of reports, the information content of which is determined in advance by the managers themselves so that they have only the information they need;
- managing information systems — serve the management levels of the organization, providing managers with the necessary information, in some cases — with interactive access to archival reports;
- automated support systems;

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- decision support systems;
- group decision support systems — designed to support collective decision making;
- decision support systems based on knowledge management.

Expert systems are applied systems of artificial intelligence, in which the knowledge base is a formalized empirical knowledge of highly qualified specialists (experts) in a certain highly specialized subject area.

Expert systems are designed to replace experts in solving problems (due to their inadequacy, low level of efficiency or in dangerous (harmful) conditions) [11].

Modernization of accounting in terms of digitalization of socio-economic relations is mainly associated with the introduction of IT tools and technologies aimed at overcoming the shortcomings of the existing control-analytical and accounting system. Efforts to increase the clarity, conciseness, and relevance of management information provision become a driving force in creating an effective accounting unit that understands management strategies and goals, and each task is performed through the prospect of overcoming excessively long or optional complex procedures with erroneous or useless results.

The actualization of the digital transformation of accounting will only increase in the future, because the use of IT innovations allows to solve new problems, modernize the concepts of information processing and transmission, contributes to the efficiency of accounting processes. To the usual functions of accounting and reporting is added the need to consolidate management processes and IT services. As a result, the quality of information support of individual departments and users, united by a single digital platform, will be increased. There is not only the conversion of data from paper to digital, but provides search, processing, synthesis of reports, control of errors and comparability, visualization of processes and their results, backup using IT tools.

Thus, IT-modernization of accounting in accordance with the requirements of the information economy should consist of software, information, organizational and methodological components. These components become the main information systems that are integrated around the web system and with each other. Reliable and scalable information-analytical system provides support and automation of management processes of all components of the organization. Qualitative development of digital services in accounting aims not only to minimize the human factor in decision-making, but also to obtain timely quality information about processes. At the same time, digitalization is a tool for creating, implementing and using the benefits of an accounting system that is enhanced by IT technologies. A well-established centralized IT process management system is able to ensure a high level of productive activity of the economic entity. Complex solutions for business process automation with the help of modern ERP-systems are actively implemented by such companies as: Kraft Deckensystem Ukraine, AMF, Import Service Group, Lysoform Medical. These enterprises are an example of a new stage in the modernization of internal IT-infrastructure: the transition from automation to integrated management systems.

The profound consequences of digitalization of accounting are possible under the condition of synergy of new concepts of information processing and transmission:

- real-time business accounting (RTA);
- electronic data interchange — from primary to reporting (EDI);
- eXtensible Business Reporting Language (XBRL);
- «cloud technologies» of computing, accounting operations based on clouds;
- artificial intelligence (AI) — modernization of mathematical modeling by modern technological innovations (assessment of stocks in warehouses with the help of software-controlled drones);
- BigData — use in calculations to increase efficiency, accuracy and speed;
- blockchain — systematization and effective control;
- soft digital infrastructures (identification and trust infrastructure, open data infrastructure, interoperability infrastructure, electronic settlements and transactions infrastructure, e-commerce infrastructure and online interaction of business entities) [7].

The sharp increase in the quantity and quality of available data and tools opens up new opportunities for their use by audit firms. One of the large companies that uses these tools in its audit services is Ernst & Young Company.

Artificial intelligence technologies and, above all, machine learning allow them to use high-quality tools of information recognition to expand the digital capabilities of auditors, namely:

- analyze and obtain information from unstructured data (such as contracts, invoices or images) to obtain additional audit evidence;
- analyze large amounts of data in order to identify risks of significant distortions due to unfair actions, as well as to respond to them.

For the customers of Ernst & Young company, this means that:

- strengthening of trust and confidence. The use of artificial intelligence technologies reduces the likelihood of errors caused by the «human factor». Such technologies provide a sequence of conclusions due to the high level of accuracy, completeness and objectivity;
- improving quality by analyzing a larger sample of data;
- increasing the beneficial effect. Artificial intelligence allows you to optimize your approach, reducing costs and improving the quality of customer service.

The company implements the latest technologies, such as artificial intelligence, at all stages of the audit, including the study of business documentation and its interpretation. This allows it to analyze more documents faster and with greater accuracy.

In turn, another example of a powerful tool in accounting is the blockchain. Blockchain is a technology of distributed peer-to-peer public network that can store information about transactions (agreements) on a permanent basis and without the possibility of its change, and which is protected by cryptographic means.

Blockchain is a technology based on accounting. It records and stores assets, liabilities, transactions and uses methods of accounting for cash flows and reconciling accounts. This is «natural» for the accounting industry, which currently relies heavily on paper to perform accounting functions in order to comply with regulatory requirements. Although this process is cumbersome, auditors still need paper to monitor the accounting records of businesses. Blockchain is important for accountants in various industries. The technology has important implications for accounting information systems, particularly in consolidating and transferring transaction information to end users. It is also important that the fundamental differences between the different blockchain options are understood and applied to the business landscape.

Blockchain is a decentralized database that allows you to check and transmit information in real time. An analogy is the idea of the blockchain as a giant Google network without its head office, accessible to network members, with participants gaining different levels of access, complemented by cryptography and other security tools to protect information.

Accordingly, a blockchain is a digital register or database stored as a system of blocks, where each subsequent block contains encrypted information about previous blocks, ie about completed transactions (hashes — short encryption results of the previous block, recorded in chronological order and viewed everyone who has access to the database) (*Fig. 2*).

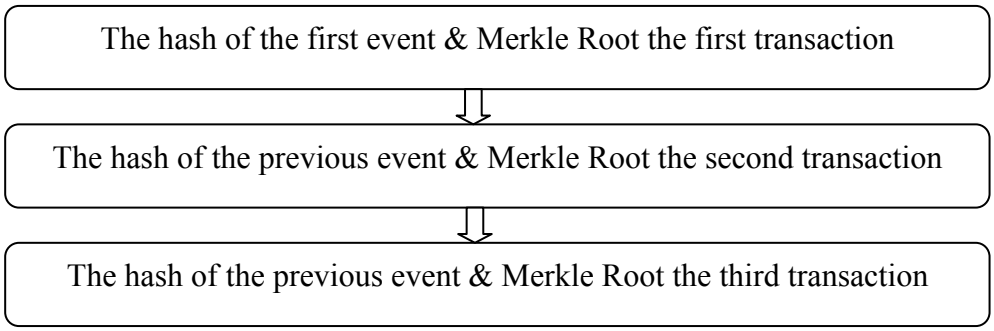

Fig. 2. **Summary view of the blockchain**

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The uniqueness of the system is that each block is closely related to the previous one, and when even one comma is changed, this hash will change, the system will not accept it, as changes will become obvious [9].

Each block is associated with a predetermined number of previous blocks, it identifies all the information contained in it, and is checked before adding to the chain without the involvement of a third party that controls the process. In a blockchain, each user («node» or participant) has a complete record of the entire blockchain, and each transaction must be approved by a majority or consensus of users.

The validation process can be computationally expensive depending on the number of validation elements and the number of blocks in the hash. For example, in a bitcoin blockchain, the current validation time is 10 minutes for each transaction. This feature provides protection against hacking most blockchains; the contents of the block cannot be viewed by the nodes (participants), and the chain cannot be changed after the block has been approved and added. The chain is created in one chronological direction, but it can be checked and read in both directions. The verification process can be customized depending on the selected blockchain option and its essence is that participants who voluntarily agree to be verifiers confirm by solving a complex mathematical problem that the hash identifiers and the information referenced by these hash identifiers, are real. Although this test is difficult to perform at the initial stage, after its approval, other nodes can test it in a short time. No single participant in the system has more power than another (*Fig. 3*).

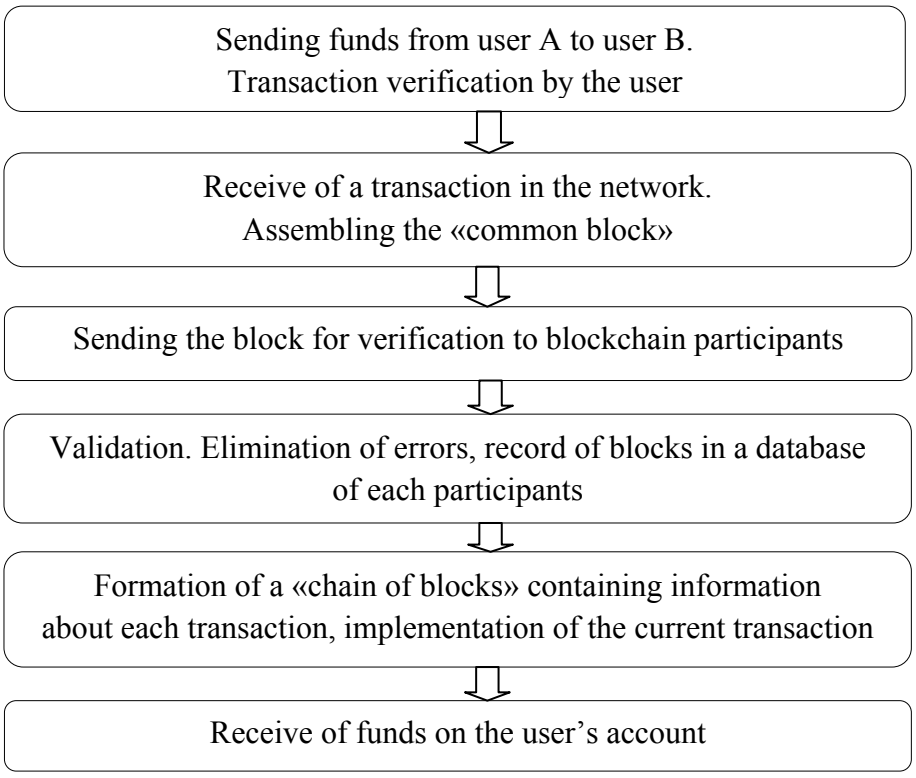

Fig. 3. **The scheme of blockchain technology in the implementation of a financial transaction**

Blockchain technology has the potential to accelerate the development of the accounting industry by reducing the cost of maintaining and reconciling books and providing absolute confidence in property rights and asset history.

Accounting with blockchain technology greatly simplifies the procurement process, as it allows you to securely record transactions, provides unprecedented transparency and increases operational efficiency. The reason is that blockchain system information is not stored in one place, it is distributed across multiple computers, ensuring system security and minimizing all risks of data leakage. To make changes to this information, you must record these changes in the next block, but others must confirm the correctness of these changes. To make changes that will be «illegal» under

the rules of the system, you need to get 51% of mining capacity, which is usually done by a group of miners who control more than 50% of the network hashrate (speed at which the computer completes bitcoin code) or computing power. In this case, attackers will be able to prevent the receipt of new confirmation transactions, which will allow them to suspend payments between some or all users. They will also be able to cancel transactions that were completed during their network control, so they can spend twice on one unit of currency. This situation is almost impossible for a large blockchain, to make a retroactive change you need to list all subsequent blocks (in the blockchain system to list more than six blocks back is impossible — there are no such computing power in the world) [8].

In Ukraine, a striking example of the use of blockchain technology in accounting is the audit and consulting company «Nexia DK».

Blockchain allows companies to record both sides of a transaction simultaneously in a shared real-time ledger, rather than simply storing verified records of financial transactions in separate privately created databases or ledgers. It intends to put the end to traditional methods of invoicing, documentation, contracts, registers, inventory systems, and payment in business.

Thus, the need for traditional double-entry accounting will be eliminated, as the verification of the integrity and legality of accounting will be fully automated within the blockchain.

This will also have a side effect on the audit process. A. Polemitis, as a leading researcher of blockchain, states: «Blockchain will eventually make a revolution in auditing. It will be able to provide machine-readable, constantly synchronized accounting records between contractors, and this will increase transparency and allow current automated audits».

Blockchain technology is also used by the international company Nestle in the field of trade, through which retailers, logistics companies and manufacturers can track goods as they move through their supply chain.

How exactly the process of using blockchain technology to track products works, let’s consider on the example of palm oil. A truck stops near a Mexican plantation to pick up fresh bunches of oil palm fruit and then deliver them to an oil refinery which is 20 km from the plantation. This palm oil will then be used in foods produced and sold by Nestlé company. Each bunch of fruits has its own built-in special RFID tag. The on-board sensor detects the bunch after it is loaded on the machine and tracks the entire path from the plantation to the processing plant using satellite technology. All data obtained at each stage of the journey is sent to Nestlé headquarters via the Open SC blockchain platform. This technology will not allow the truck to stop on the road and pick up the fruit from some other farm. It guarantees that the plant receive fruits only from the specified plantation. Accordingly, thanks to the use of this technology customers will be allowed independently, by bouncing, QR-code on the package with a smartphone to track the freshness of the purchase.

So, using a blockchain, instead of storing individual records based on transaction receipts, companies can record their transactions directly in the consolidated register, creating an interconnected system of stable accounts. Because all records are distributed and cryptographically sealed, the chances of destroying or manipulating them to hide activity are slim. The procedure can be compared with a transaction certified by a notary, only in this case by an electronic notary.

These considerations lead to the conclusion that blockchain technology promises the following benefits to accounting services:

- reducing the number of errors — when data enters the blockchain, intelligent contracts make many accounting functions automatic, reducing the likelihood of human error;
- cost reduction — blockchain will increase the efficiency of the accountant and reduce the number of errors, which in the medium term will help reduce the cost of accounting and verify its correctness;
- reduce the likelihood of fraud — to change the record in the blockchain, you must make the same change for all copies of the distributed network at the same time, which is almost impossible;

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- reduction of audit time — with the help of intelligent contracts you can automate many audit functions, and this will reduce the time required by the auditor to view records.

Blockchain as a source of trust can be extremely useful in today's accounting industry. It can be gradually integrated with standard accounting procedures: from ensuring the integrity of records to fully traceable audit ledgers. As a result the fully automated audit process will be the reality.

By adopting blockchain technology, accounting firms will be able to offer their clients the security and preservation of all accounting records that can be accessed by those who are interested and have the right to access this information. Such persons include auditors, tax authorities and other state executive bodies authorized to exercise control in the financial sphere at the enterprise level.

Thanks to blockchain technology, the process of creating records and recording the time of their creation will affect accounting in such a way that all events will remain forever and unchanged. Documents will not be able to be changed during their life cycles. Business processes involving several departments or even companies are recorded and fully tracked. In addition, smart contracts can lead to the fact that invoices will be paid automatically after confirmation of receipt of the goods.

Of course, with the active introduction of such technology in accounting processes there is a question of professional development of accountants. Since, on the one hand, the functions of the accountant at the level of primary documentation are reduced due to active automation of accounting, and on the other hand, the principle of blockchain provides greater transparency and the question of what functions it will perform becomes relevant. Accountants will spend much less time entering data into the database, recording the facts of economic life, but will be able to spend more time preparing professional opinions, interpreting the economic content of transactions and the correct reflection of transactions in accounting and reporting. But for this it is necessary to improve the skills of accountants and restructure their way of thinking. An accountant must become not just an accountant, but also a professional analyst who is familiar with the economic processes of his organization.

Technological changes may also affect the software used by accounting staff. Many modern accounting systems use «cloud storage» to store financial information, which is centrally located in some data centers. Blockchain will use the Internet to enable small individual business-level accounts and other databases to interact with databases of other similar smaller (or even larger) business objects [10].

Conclusions. In the period of digital transformation of socio-economic relations, the conservatism of accounting should not interfere with innovative, formalized, dynamic, focused on the user's information needs of changes of theoretical and practical nature.

Thus, changes in technology have led to a paradigm change in accounting, which requires scientists and practitioners to work together to form a model of basic concepts, develop legislation, regulations, instructions and regulations on accounting in the new digital economy.

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