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THE ROLE OF BLOCKCHAIN IN OPTIMISING BUSINESS PROCESSES IN THE DIGITAL ECONOMY

РОЛЬ БЛОКЧЕЙНУ В ОПТИМІЗАЦІЇ БІЗНЕС–ПРОЦЕСІВ ЦИФРОВОЇ ЕКОНОМІКИ

Summary. The article explores the potential of blockchain technologies as a tool for optimising business processes in the context of the digital economy. Based on the analysis of theoretical foundations and practical examples, the article shows that blockchain contributes to the transformation of traditional business models by increasing transparency, reducing transaction costs, automating contractual interactions and reducing fraud risks. Special attention is paid to the use of smart contracts, supply chain management, financial transactions and audit. A comparative analysis of the advantages and challenges of implementing blockchain technologies in the field of entrepreneurship is proposed, which allowed identifying key barriers – lack of a regulatory framework, complexity of integration with existing IT systems, high financial costs, and insufficient level of digital literacy of personnel. The author emphasises that further development and effective implementation of blockchain technologies is possible if they are combined with other digital tools, in particular, artificial intelligence, the Internet of Things and big data processing technologies. It is concluded that blockchain is not only a technological tool but also a strategic factor in the development of the digital economy, capable of forming a new architecture of economic interaction and strengthening the competitive position of enterprises.

Keywords: business processes, digital economy, blockchain, financial instruments, financial transactions, optimisation.

Problem statement. In the current global digitalisation environment, the economy is undergoing significant transformations that are changing the nature of business interactions, financial transactions and the organisation of management processes. The dynamic development of the digital economy and the active introduction of the latest technologies create preconditions for revising traditional approaches to the organisation of business processes, and also lead to a growing need for more efficient, secure and transparent tools for interaction between economic agents.

At the same time, existing business models are often characterised by a high dependence on intermediaries, complex trust mechanisms and significant transaction costs. In this context, blockchain technology is of particular interest, as it has unique characteristics that can potentially solve a number of structural problems in the modern economy. These include decentralisation, transparency, and data immutability, which enable the automation of contractual obligations, minimise the human factor, reduce fraud risks, and increase trust in transactional activities.

Despite the obvious advantages, the widespread adoption of blockchain technologies faces a number of challenges, including regulatory restrictions, low digital literacy of users, technological complexity of integration into traditional systems, and insufficiently studied economic consequences of large-scale

blockchain use. This is why there is a need for an in-depth study of the potential of blockchain technology as a tool for transforming modern economic processes, analysing its impact on business performance and shaping a new architecture of economic interaction in the digital era.

Analysis of recent research and publications. Although blockchain as a factor in the digital transformation of the economy is a new technology, there are many scientific works in this area. In particular, G. Prause in his work [1] notes that new concepts for information management are now needed, which indicates the possibility of using blockchain for this purpose. The features of blockchain technology are highlighted in the articles M. Liu, K. Wu, J. Xu [2], Y. Cong, H. Du i M. Vasarhelyi [3]. The impact of blockchain technology and artificial intelligence on accounting, the problems of implementing this technology in accounting and auditing practice are studied in the works of H. Han, R. Shiwakoti, R. Jarvis, Ch. Mordi and D. Botchie [4]. Monti M. and Rasmussen S. [5] propose an electronic architecture that will integrate multiple infrastructures, which may be based on blockchain. Esmaeilian B., Sarkis J., Lewis K. and Behdad S. [6] explore the role blockchain can play in moving supply chains towards sustainable development. Paliwal V., Chandra S. and Sharma S. [7] reviewed the role of blockchain technologies in sustainable supply chain management and showed the great power and role of information systems based on blockchain technology. The use of blockchain technology to minimise the risk of accounting errors and reduce the level of financial fraud is highlighted in the article by the authors A. Faccia and N. Mosteanu [8].

The World Economic Forum report notes that digital technologies such as the Internet of Things (IoT), artificial intelligence (AI) and blockchain have the potential to significantly change the way we do business, contributing to the achievement of sustainable goals [9]. Scientists also note the environmental benefits of digital transformation. For example, the use of Big Data and AI to optimise logistics processes can reduce CO2 emissions by 10–15%, as confirmed by the International Energy Agency study. In addition, companies that integrate digital technologies into their operational processes can reduce energy and water consumption, contributing to the conservation of natural resources [10].

Among domestic scholars, we can single out I. Davidova [11], who analysed the positive features of the blockchain and the problems that may arise when using it, and V. Babenko et al. [12], who considered the prospects of cooperation with the EU in the use of blockchain. It is also necessary to note the study of the principles of using digital technologies in financial management, which are set out in the works of T. O. Shmatkovska. In particular, the author examines how digital technologies such as blockchain and artificial intelligence are changing the way strategic accounting and financial services are conducted, and also identifies the risks associated with these changes [13].

Identification of previously unsolved parts of the general problem. Among all the studies, the issue of the role of blockchain technology in optimising business processes in the context of the digital transformation of the economy remains unresolved.

The purpose of the article is to explore the possibilities of using blockchain technologies to optimise business processes in the digital economy and to determine their impact on the efficiency of modern entrepreneurship.

Presentation of the main material. In today's globalised environment and rapid development of information and communication technologies, digital transformation is becoming increasingly important as a strategic business development area. The concept of digital transformation encompasses not only the modernisation of technical infrastructure, but also a profound restructuring of internal business processes, corporate culture and decision-making approaches [14]. It involves the integration of digital technologies into all aspects of the enterprise, which allows for significant improvements in productivity, flexibility and innovation.

According to scientific approaches, digital business transformation is implemented by rethinking existing strategies, operating models and ways of interacting with customers using modern technologies such as Big Data, Cloud Computing, Artificial Intelligence, Internet of Things (IoT), etc. It is aimed at achieving a long-term competitive advantage, improving the efficiency of management decisions and expanding market opportunities for companies [15].

Nowadays, the digitalisation of enterprises is an important driver of economic growth, which is manifested through the optimisation of production and logistics processes, reduction of transaction costs, improvement of the quality of products and services, and increase in labour productivity. The implementation of digital solutions allows companies to adapt to a dynamic market environment, minimise risks, increase financial security, respond quickly to changes in demand and make strategically sound management decisions [16].

Big data analytics is becoming particularly relevant, providing a deep understanding of consumer behaviour, forecasting market trends and improving products. This

helps to increase the adaptability of organisations and develop customer-centric business models.

One of the key technologies for digital transformation is artificial intelligence, which is used to automate operations, recognise patterns in large amounts of data, create personalised offers, and perform predictive analytics. Machine learning enables businesses to improve the accuracy and speed of management decision-making, reduce costs and increase customer satisfaction.

Blockchain technology is also playing an increasingly important role in the digital economy by providing new opportunities to make business processes more transparent, secure and efficient. The main areas in which it is used include:

– automation through smart contracts, which allow transactions to be executed without intermediaries and ensure the automatic fulfilment of obligations when certain conditions are met;

– supply chain management is another key area, helping to improve the traceability of goods, guarantee their authenticity, and increase the transparency of logistics operations;

– financial transactions are becoming faster, cheaper and less vulnerable to fraud thanks to blockchain technologies;

– auditing and reporting also benefit from blockchain technology, as an immutable record of data helps build trust and ensure compliance with regulatory requirements.

Table 1 provides a comparative analysis of the benefits and challenges of implementing blockchain technologies in business.

Blockchain technology plays an important role in the transformation of the modern business environment, as it allows not only to increase operational efficiency but also to create qualitatively new mechanisms for building trust between participants in economic interaction. Due to its decentralised nature and technological features (in particular, data immutability, transparency and a high level of information security), blockchain creates preconditions for minimising the risks of fraud, abuse and unauthorised interference. This is especially important in the context of the growing volume of electronic transactions and increased cybersecurity requirements.

The growing need for transparency in business processes and guarantees of transaction authenticity is driving the adoption of blockchain technology as a foundation for digital trust. Blockchain has the potential to transform the way contractual relations, financial transactions, accounting, logistics and personal data management are organised. Smart contracts allow the automatic fulfilment of agreement terms, reducing time costs, eliminating the human factor and increasing interaction efficiency between parties.

At the same time, the large-scale implementation of blockchain solutions is facing a number of serious challenges. One of the key issues is the absence of a consistent legal interpretation and regulatory framework for the technology, both nationally and internationally. This creates legal uncertainty surrounding the status of smart contracts, data privacy and liability for actions taken in a decentralised environment. Additionally, the substantial capital investment required to integrate blockchain into existing IT infrastructures restricts its potential applications, particularly for small and medium-sized businesses.

In addition, it is worth noting that the spread of blockchain creates new requirements for the level of digital competence of personnel, which requires systematic educational and awareness-raising work among specialists in various fields. Without proper training, the effective implementation of the technology can be significantly complicated.

Table 1

Comparative analysis of the benefits and challenges of implementing blockchain technologies in business

Aspect	Advantages of Blockchain Implementation	Key Challenges and Limitations
Trust among participants	Decentralization eliminates intermediaries; enhances trust	Low confidence in new technologies among traditional business actors
Transparency and traceability	Data availability for all participants; reduced fraud risks	Confidentiality concerns may hinder use in certain sectors
Transaction security	Cryptographic protection and data immutability	Need for specialized knowledge and skilled personnel for proper administration
Operational efficiency	Process automation through smart contracts; reduced time and costs	High initial investments and complex integration with legacy systems
Regulatory and legal frameworks	Potential for audit simplification and compliance improvement	Lack of unified regulatory approach across jurisdictions
Scalability and innovation	Flexibility and potential for building digital ecosystems	Technical constraints (throughput, energy consumption)

Source: systematised by the authors

Despite these challenges, the use of blockchain technologies in strategically important sectors of the economy, including agriculture, healthcare, banking, insurance, and public administration, is showing positive trends, as evidenced by analytical data. Integrating blockchain with related digital technologies such as artificial intelligence, the Internet of Things and big data analytics forms the basis for developing intelligent digital ecosystems that can provide a high level of automation, adaptability and cybersecurity.

Therefore, blockchain should be viewed not only as a tool for the digital modernisation of individual business processes, but also as a systemic factor in the strategic transformation of the digital economy as a whole. Implementing it creates the potential to establish a new management paradigm, boost enterprise competitiveness, foster trust in the digital environment and ensure the sustainable development of innovation.

Conclusions and suggestions. Based on the study, it can be concluded that blockchain technologies have significant potential in optimising business processes in the digital economy. Their application helps to increase transparency, security, efficiency and trust between participants in economic interaction. Smart contracts, as a key functional tool of the blockchain, allow automating the execution of transactions, minimising transaction costs and eliminating the need for intermediaries.

At the same time, blockchain technology is proving effective in areas such as logistics, financial settlements, auditing and public administration. It is ensuring the sustainable transformation of traditional business models. While the results of the comparative analysis highlight the significant advantages of implementing this technology, they also reveal systemic barriers in the form of legal, technical, organisational and human resource issues.

The further spread of blockchain solutions requires a comprehensive approach, including the creation of a favourable regulatory environment, the development of digital competences of personnel, and the integration of blockchain with other innovative technologies of the digital economy. In such a combination, blockchain can become the basis for new business models and digital ecosystems that ensure high adaptability, innovation and competitiveness of enterprises in the global environment.

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Анотація. У статті здійснено комплексне дослідження ролі блокчейн-технологій в оптимізації бізнес-процесів в умовах цифрової економіки. Автором проаналізовано, як стрімкий розвиток цифрових технологій трансформує традиційні підходи до організації підприємницької діяльності, обумовлюючи необхідність впровадження інноваційних інструментів, що забезпечують вищу ефективність, надійність та прозорість взаємодії між економічними суб'єктами. У такому контексті блокчейн виступає як одна з провідних технологій, що здатна стати основою нових форм цифрової взаємодії та підтримки сталого розвитку бізнесу. У фокусі дослідження – можливості використання блокчейн-рішень для автоматизації договірних зобов'язань (смарт-контракти), підвищення безпеки фінансових транзакцій, забезпечення прозорості логістичних операцій, формування надійних механізмів аудиту та звітності. На прикладах успішного впровадження блокчейну в різних секторах (фінанси, логістика, охорона здоров'я, агробізнес, державне управління) обґрунтовано здатність технології значно підвищувати ефективність бізнес-процесів, знижувати витрати та покращувати клієнтоорієнтованість. Водночас автор акцентує увагу на існуючих бар'єрах і викликах, що гальмують масове впровадження блокчейну. До них належать: недосконале правове регулювання, високі витрати на впровадження та обслуговування, складність інтеграції з існуючими IT-системами, а також брак кваліфікованих кадрів із необхідним рівнем цифрової грамотності. Підкреслюється важливість комплексного підходу до впровадження блокчейн-технологій із врахуванням потреб цифрової трансформації підприємств, специфіки галузевої політики та розвитку цифрової інфраструктури. У межах дослідження також запропоновано аналітичну таблицю, яка систематизує ключові переваги та обмеження застосування блокчейн у бізнес-середовищі. Автором зроблено висновок, що блокчейн виступає не лише інструментом технологічної модернізації, а й стратегічним ресурсом, здатним формувати нову архітектуру економічної взаємодії, підвищувати конкурентоспроможність підприємств та сприяти формуванню інтегрованих цифрових екосистем.

Ключові слова: бізнес-процеси, цифрова економіка, блокчейн, фінансові інструменти, фінансові операції, оптимізація.