

DOI 10.32782/2786-8559/2024-5-10
UDC 654.07

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ANALYSIS OF THE USE OF BLOCKCHAIN AND SMART CONTRACT TECHNOLOGIES FOR MANAGEMENT AUTOMATION AND ENSURING BUSINESS RESILIENCE

Increasing competition, the need to enhance efficiency and transparency of business processes, as well as the requirements to ensure the security and reliability of operations, demand new tools and approaches for automating management and ensuring the sustainability of the enterprise. Currently, it is blockchain and smart contract technologies that are opening up vast opportunities for this. Therefore, the research is aimed at a comprehensive analysis of the features and directions of using blockchain and smart contract technologies for automating management and ensuring the sustainability of the enterprise. Within the research, it has been proven that the use of blockchain and smart contract technologies creates a flexible and secure process for developing conditions and strategies that allow an enterprise to function effectively and remain capable of ensuring its own progressive development even in conditions of high stochasticity, economic turbulence, or crises. It is concluded that among the main directions where the use of blockchain technologies for ensuring enterprise resilience is worthwhile, the following should be highlighted: supply chain management, balanced management, security management, and basic risk management, as well as managing relationships with customers and partners. In unity, these outlined directions establish the principles of automating enterprise management, enhance its ability to function effectively, and direct its progressive development. It is concluded that among the main directions where the use of smart contracts for ensuring enterprise resilience is beneficial, the following should be highlighted: access and security management, remote tracking of resource utilization, automation of production and commercial processes, improvement of customer service, and management of data processing workflows. In unity, these outlined directions establish the principles of enterprise management automation, guiding and expanding the enterprise's capabilities for progressive development. In the context of ensuring enterprise resilience, the goal of applying smart contracts and blockchain technologies can vary. However, the use of these outlined technological solutions should guarantee the enterprise's ability to withstand external and internal influences.

Keywords: *business, data protection, transparency and openness, remote collaboration, strategy.*

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АНАЛІЗ ВИКОРИСТАННЯ ТЕХНОЛОГІЙ БЛОКЧЕЙН ТА SMART-КОНТАКТІВ ДЛЯ АВТОМАТИЗАЦІЇ МЕНЕДЖМЕНТУ ТА ЗАБЕЗПЕЧЕННЯ СТІЙКОСТІ ПІДПРИЄМСТВА

Зростання конкуренції, потреба у підвищенні ефективності та транспарентності бізнес-процесів, а також вимоги до забезпечення безпеки та надійності операцій вимагають нових інструментів та підходів до автоматизації менеджменту та забезпечення стійкості підприємства. Наразі саме технології блокчейн та smart-контрактів відкривають широкі можливості для цього. Таким чином, дослідження спрямоване на загальний аналіз особливостей та напрямків використання технологій

блокчейн та smart-контрактів для автоматизації менеджменту та забезпечення стійкості підприємства. У межах дослідження доведено, що за умов використання технологій блокчейн та smart-контрактів формується гнучкий та безпечний процес створення умов і стратегій, що дозволяють суб'єкту господарювання ефективно функціонувати та залишатися спроможним забезпечувати власний поступальний розвиток навіть в умовах високої стохастичності, економічної турбулентності чи кризових. Зроблено висновок, що серед основних напрямків, за якими доцільне використання технологій блокчейн для забезпечення стійкості підприємства: управління ланцюгом постачання, балансове управління, управління безпекою діяльності та базовими ризиками, управління взаємовідносинами з клієнтами та партнерами. У єдності окреслені напрямки визначають засади автоматизації менеджменту підприємства, посилюють його здатність до ефективного функціонування, спрямовують його поступальний розвиток. Зроблено висновок, що серед основних напрямків, за якими доцільне використання smart-контрактів для забезпечення стійкості підприємства: управління доступом та безпекою, віддалений облік використання ресурсів, автоматизація виробничих та комерційних процесів, покращення обслуговування клієнтів, управління процесами роботи з даними. У єдності окреслені напрямки визначають засади автоматизації менеджменту підприємства, спрямовують та розширюють його можливості до поступального розвитку. В контексті та забезпечення стійкості підприємства мета застосування smart-контрактів та блокчейн технологій може бути різноманітною, разом з тим, використання окреслених технологій має гарантувати йому здатність витримувати будь-які зовнішні та внутрішні впливи.

Ключові слова: бізнес, захист даних, прозорість та відкритість, віддалена взаємодія, стратегія.

Introduction. The increasing competition, and the need for enhancing the efficiency and transparency of business processes, as well as the requirements for ensuring the security and reliability of operations, demand new tools and approaches for automating management and ensuring the resilience of the enterprise. Currently, blockchain and smart-contract technologies are opening a vast means to do this. Indeed, blockchain has proven its effectiveness as a means of reducing costs and risks, as well as increasing trust among participants in the business ecosystem, while smart contracts serve as a tool for automating contract execution and enhancing the security of operational processes. Therefore, the combination of these two technologies allows enterprises to effectively respond to the challenges of modern business, ensuring their resilience in the global market environment.

Materials and methods. The issues of management automation and ensuring enterprise resilience are extensively covered in the scientific literature. In particular, they are actively researched by scholars such as Garafonova O., Zhosan G., Mashika H., Zelic V., Kiziun A., Maslyhan R., and others. Researchers point out that these issues are open to new technologies, among which the most promising are blockchain (which allows data to be stored in a distributed network) and smart contract tools. However, in the Ukrainian context, the experience of using blockchain and smart contract technologies for automating management and ensuring enterprise resilience is still insufficiently explored and requires further research for implementation in the domestic economy.

The purpose of the article is a general analysis of the features and directions of using blockchain and smart contract technologies for automation of management and ensuring the sustainability of the enterprise.

Results. According to the analysis of definitions of economic sustainability as a management category (see Table 1), it can be interpreted as [1; 6; 8-9]:

- the ability of an enterprise to adapt its activities to changes in the external and internal environment of its functioning;
- ability to withstand external and internal influences (such as economic fluctuations, market competition, changes in legislation, etc.).

Considering that enterprise resilience cannot be achieved through isolated strategies (such as business diversification, risk management, stabilizing financial status, and others), their flexible combination is necessary, which requires enterprises to transition to blockchain and smart contract technologies [7].

These technologies not only create opportunities for automating long-term processes but also for improving the security and reliability of the mentioned areas.

Given the outlined significance, according to EY data, the number of foreign enterprises applying blockchain and smart contract technologies in the outlined area is over 7 million entities.

Globally, blockchain and smart contract technologies are transforming the business landscape, providing greater efficiency, security, and reliability. However, in the Ukrainian landscape, such enterprises are practically non-existent. The absence of such enterprises in Ukraine can be attributed to various factors, including the limited development of infrastructure for blockchain technologies implementation, insufficient awareness in this field among businesspeople, and a regulatory vacuum. However, growing awareness and government support can contribute to the spread of such technologies in the Ukrainian business environment [7].

In particular, blockchain is a decentralized database that ensures the security and reliability of storing

Table 1 – Analysis of modern approaches to defining the economic sustainability of an enterprise

Source	The essence of the author's interpretation	The specification of the content of management
Aleksyeyenko N.V. [1]	It is the equilibrium state of an enterprise, in which economic and managerial decisions can regulate the main factors of a stable position of the enterprise: prices, management, production, finances, personnel, and strategy, taking into account competition, within a given risk limit.	<i>Indicates the ability to adapt the activities of the enterprise by changes in the external and internal environment of its functioning</i>
Tkachenko S.M. [7]	It is a state that determines the ability to ensure one's progressive development, without deviating from a given direction of movement under any internal or external influences	
Kiver A.V., Kraynyuchenko O.F. [4]	The ability of an enterprise to ensure a state of equilibrium in the face of destabilizing factors in the internal and external environment	<i>Indicates the ability of an enterprise to maintain equilibrium in its functioning amidst changes in the external and internal environment</i>
Simakh Yu. [6]	The state of equilibrium in which the enterprise has a positive dynamic of functioning, or does not go beyond the established limits	

Source: formed based on [1;4; 6-7]

information about the activities of an enterprise by distributing its copies on different computers in the network [2].

Smart contracts are blockchain-based programs that automate certain types of operations (in particular, they automatically execute the terms of agreements set out in their code) and enhance the security and reliability of operational processes (based on cryptography technology).

Thus, through the combined use of blockchain and smart contract technologies, a flexible and secure process is formed for creating conditions and strategies that allow the business entity to function effectively and remain capable of ensuring its progressive development even in conditions of high stochasticity, economic turbulence, or crises [6-7].

So, among the main directions where the use of blockchain technologies for ensuring enterprise resilience is beneficial, the following should be highlighted:

1. Supply chain management. In this context, blockchain is used to track goods from the supplier to the end consumer and allows enterprises to [2; 4]:

- improve the efficiency of supply chain management;
- improve the transparency and reliability of information on the status of order fulfillment and product supply.

2. Strengthening financial transparency. In this case, blockchain is used to conduct financial transactions and allows enterprises to:

- increase the level of transparency and security in the exchange of financial assets;
- increase the level of trust of stakeholders.

3. Balance sheet management. In this case, blockchain is used to track and manage resources and assets, allowing enterprises to:

- achieve maximum efficiency in the use of resources and assets;

- ensure high balance sheet liquidity;
- create a transparent system for the movement of resources and assets, as well as for the registration and tracking of intellectual property rights [3].

4. Activity security and basic risk management. In this case, blockchain is used to provide a high level of protection against cyberattacks, allowing enterprises to reduce the risks of fraud, errors, and misconduct due to its reliability and transparency (due to its decentralized nature and cryptographic protection methods [5]).

5. Customer and partner relationship management. In this case, blockchain is used to create customer and partner relationship management systems, allowing companies to [3; 5]:

- improve communication with customers;
- strengthen cooperation with their stakeholders.

These directions define the principles of enterprise management automation, strengthen its ability to function effectively (due to the security and transparency of its core activities) and direct its progressive development.

The outlined provisions allow us to highlight the role of blockchain in the automation of management and ensuring the sustainability of the enterprise (Fig. 1).

It should be noted that in the context of ensuring the sustainability of an enterprise, the purpose of using blockchain can be varied and depends on the specific needs and circumstances.

Thus, it is possible to create decentralized operating systems, protect data, ensure transparency and openness in data exchange, create authentication and identification systems, automate and optimize managerial or operational processes.

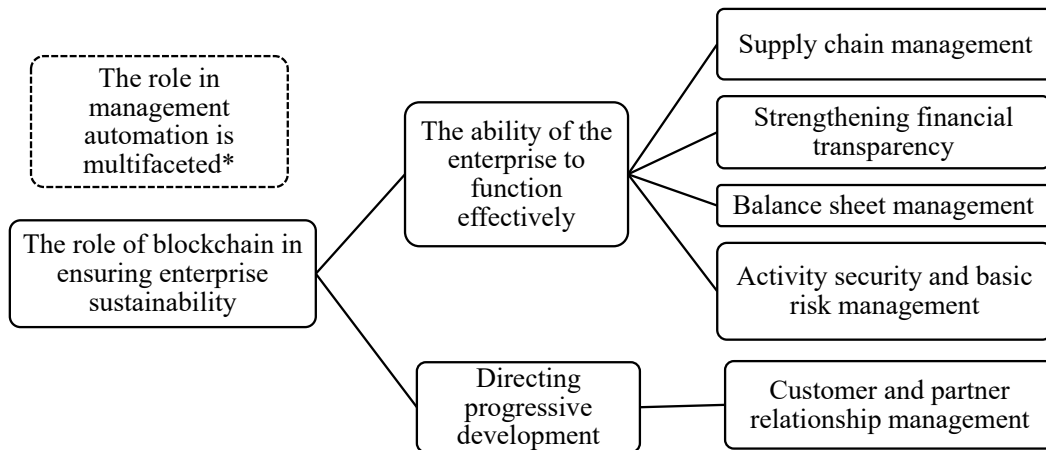


Figure 1 – The role of blockchain in management automation and ensuring enterprise sustainability

Note

* Creation of decentralized operating systems, data protection, transparency and openness in data exchange, creation of authentication and identification systems, automation and optimization of managerial or operational processes, promotion of new technological solutions and innovations

Source: formed based on [1-2; 7]

Among the main areas where the use of smart contracts (together with wireless technologies such as Bluetooth, Wi-Fi, NFC, etc.) is advisable to ensure the sustainability of an enterprise, it is necessary to highlight:

1. Access and security management. Smart contract systems are used to monitor access to premises or objects, which helps enterprises to:

- strengthen the security of production and premises;
- control the level of access of employees and guests to production facilities.

Some smart contracts are suitable for remote security provision (automatic door opening or user authentication using biometric data [2]).

2. Remote resource usage accounting. Smart contract systems are used to monitor resource usage (such as energy, water, gas, etc.), which helps enterprises to:

- optimize resource usage;
- reduce resource costs [3; 5].

3. Automation of production and commercial processes. So, smart contract systems are used to automate many production and commercial processes in the enterprise, which contributes to increasing their efficiency and reducing costs. Such systems allow automation of many stages of the production process, starting from raw material inventory control to production line management and product quality monitoring.

4. In the commercial sphere, smart contracts can be used to automate inventory management processes, sales of goods and services, order fulfillment, etc. For example, they can automatically track inventory levels and order new products or materials in time to avoid delays in production or sales.

5. Improving customer service. It should be noted that the integration of smart contracts into products or services can improve the way you interact with customers. For example, the use of mobile applications with NFC support increases the convenience for the customer to pay or receive additional information about products.

6. Data workflow management. So, smart contract systems are used to collect and analyze data on work processes, which helps enterprises to:

- improve the validity of management decisions;
- see in real-time the directions for optimizing the enterprise’s activities.

The directions outlined above define the principles of enterprise management automation, direct and expand the enterprise’s opportunities for progressive development (through awareness of the effectiveness of commercial and production processes, identification of opportunities for improvement and cost reduction [2]). The formulated provisions allow us to highlight the role of smart contracts in the automation of management and ensuring the sustainability of the enterprise (Fig. 2).

The directions outlined above define the principles of enterprise management automation and direct and expand the enterprise’s opportunities for progressive development (through awareness of the effectiveness of commercial and production processes, identification of opportunities for improvement, and cost reduction). The formulated provisions allow us to highlight the role of smart contracts in the automation of management and ensuring the sustainability of the enterprise (Fig. 2).

Additional benefits for the enterprise from using smart contracts include improved management

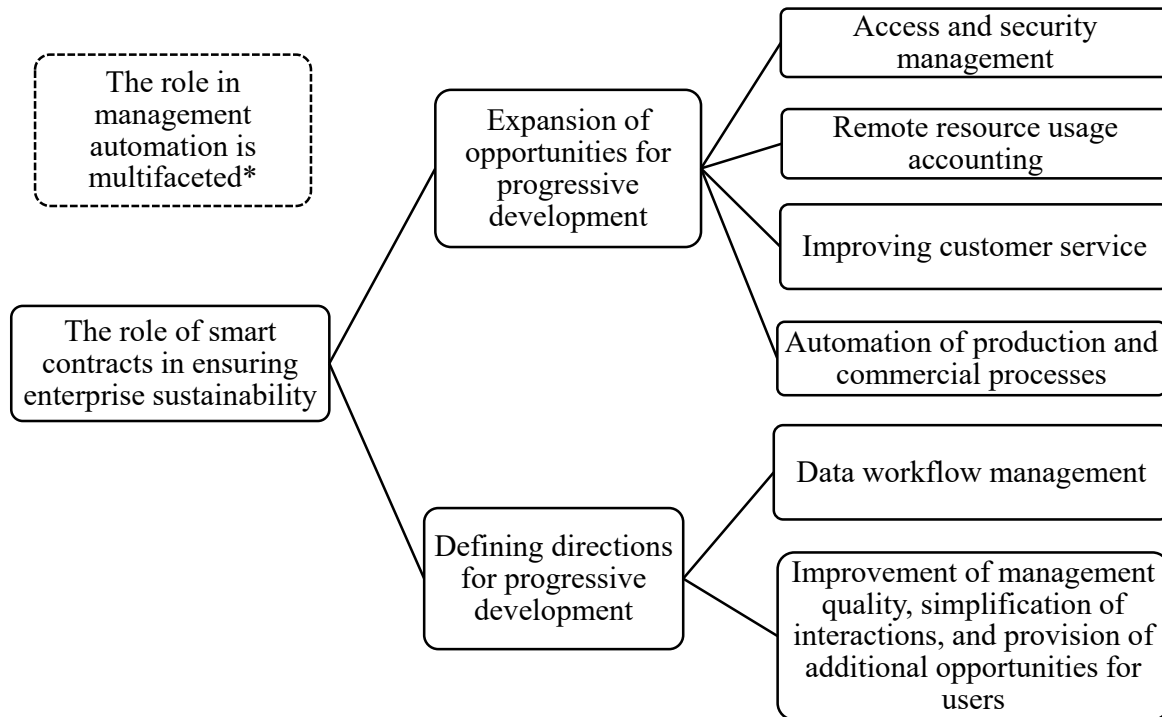


Figure 2 – The role of smart contracts in management automation and ensuring enterprise sustainability

Note

*Creating opportunities for automatic information retrieval, monitoring various indicators of the enterprise, remote interaction with the environment (by identifying objects around or providing interactive information about them), remote security provision
Source: formed based on [2; 5; 7]

quality, simplified interactions, and providing additional opportunities for users.

Overall, the use of blockchain and smart contract technologies can guarantee the enterprise's ability to withstand external and internal influences.

Conclusions. The study proves that the use of blockchain and smart contract technologies creates a flexible and secure process for establishing conditions and strategies that allow a business entity to function effectively and remain capable of ensuring its progressive development even in conditions of high stochasticity, economic turbulence, or crisis. In this regard, the following conclusions have been made:

1. Among the main areas where the use of blockchain technologies is advisable to ensure the sustainability of an enterprise, it is necessary to highlight supply chain management, balance sheet management, activity security and basic risk management, and customer and partner relationship management. In unity, the outlined directions define the principles of enterprise management automation, strengthen its

ability to function effectively and direct its progressive development.

2. Among the main areas where the use of smart contracts is advisable to ensure the sustainability of an enterprise, it is necessary to highlight access and security management, remote resource usage accounting, automation of production and commercial processes, improvement of customer service, and data workflow management. In unity, the outlined directions define the principles of enterprise management automation and direct and expand the enterprise's opportunities for progressive development.

3. In the context of ensuring enterprise sustainability, the purpose of utilizing smart contracts and blockchain technologies can be diverse. Nevertheless, the implementation of these technological solutions should guarantee the enterprise's capacity to withstand external and internal pressures.

The obtained results create opportunities for studying the impact of regulatory norms and standards on the effectiveness of implementing blockchain technologies and smart contracts

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Стаття надійшла до редакції 07.06.2024 р.