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BLOCKCHAIN INNOVATIVE TECHNOLOGY AS A COMMUNICATION BASIS FOR THE DIGITAL ECONOMY FORMATION

У статті наведено аналіз використання технологій розподіленого реєстру (блокчейн) в різних сферах економіки, фінансів, а також соціально-економічного життя суспільства. Показано, що технологія блокчейн останнім часом викликає безперечний інтерес. Наголошується на тому, що технологія блокчейн є однією з найбільш обговорюваних тем у галузі розвитку цифрової економіки, а увага до цієї технології найближчим часом буде лише зростати. Показано, що на цей час не існує стандартів і правових відносин використання такої технології. З цієї причини деякі серйозні учасники ринку об'єдналися в консорціуми для створення стандартів щодо практичного впровадження і використання цієї технології. У статті аналізуються питання, які стосуються передумов появи технології блокчейн, наводиться її визначення як багатофункціональної інформаційної системи, призначеної для обліку різних активів. Здійснено аналіз значних переваг цієї технології. При цьому розглянуто її недоліки, які на сьогодні ще не усунуто і які потребують окремого дослідження.

У статті розкрито перспективи застосування технології блокчейн у різних сферах економіки, фінансів, а також аналізується використання цієї технології в інших сферах життєдіяльності, не пов'язаних з економікою. На основі проведеного дослідження визначено перспективні напрями розвитку технології в Україні та за кордоном. Однак у кожному окремому випадку необхідно встановлювати доцільність, оцінювати ризики, стежити за безпекою, готувати кадри.

Обґрунтовано можливість підвищення ефективності функціонування підприємств шляхом використання блокчейну разом з іншими ресурсами підприємства.

***Ключові слова:* блокчейн, інноваційні технології, цифрова економіка, інформаційні технології, електронні транзакції, криптовалюта, розподілені дані.**

В статье представлен анализ использования технологий распределенного реестра (блокчейн) в различных сферах экономики, финансов, а также социально-экономической жизни общества. Показано, что технология блокчейн вызывает в последнее время бесспорный интерес. Отмечается, что технология блокчейн является одной из самых обсуждаемых тем в области развития цифровой экономики, а внимание к данной технологии в ближайшее время будет только возрастать. Показано, что в настоящее время не существует стандартов и правовых отношений

в использовании такой технологии, по этой причине некоторые серьезные участники рынка объединились в консорциумы для создания стандартов по практическому внедрению и использованию этой технологии.

В статье анализируются вопросы, относящиеся к предпосылкам появления технологии блокчейн, приводится ее определение как многофункциональной информационной системы, предназначенной для учета различных активов. Осуществлен анализ значительных преимуществ рассматриваемой технологии. При этом рассмотрены ее недостатки, которые на сегодняшний день еще не устранены и нуждаются в отдельном исследовании.

В статье раскрыты перспективы применения технологии блокчейн в различных сферах экономики, финансов, а также анализируется использование этой технологии в других сферах жизнедеятельности, не связанных с экономикой. На основе проведенного исследования определены перспективные направления развития технологии в Украине и за рубежом. Однако в каждом отдельном случае необходимо устанавливать целесообразность, оценивать риски, следить за безопасностью, готовить кадры.

Обоснована возможность повышения эффективности функционирования предприятия путем использования блокчейна наряду с другими ресурсами предприятия.

Ключевые слова: блокчейн, инновационные технологии, цифровая экономика, информационные технологии, электронные транзакции, криптовалюта, распределенные данные.

Introduction. The innovative *blockchain* technology is still in its infancy, and some researchers still treat it with a degree of distrust. However, among the features of its application and its inherent features, one can identify a severe potential that eliminates the current level of such distrust. Note that the “*blockchain*” concept has been actively discussed along with the cryptocurrency growing popularity. There is a strong belief that this technology can be a real breakthrough in economics, finance, and secure databases. The *blockchain* consists of a chain of blocks being stored on different computers containing a timestamp and a link to the previous block.

In exploring the issue related to the *blockchain* technology concept, we would like to emphasize that the system does not have a single server; the *blockchains* are distributed among users. Modern encryption algorithms protect individual records belonging to a particular person from copying (editing) by other users of the system.

The *blockchain* technology concept was proposed by Satoshi Nakamoto [1] in 2008. That paper presented the basic principles of building a peer-to-peer payment system to make electronic transactions among participants in the system, bypassing financial institutions - intermediaries. It was first put into practice with the advent of

Bitcoin in 2009. The noted origin refers to cryptocurrency transactions, but the technical scope is far broader.

Algorithmically, such a system operates as follows:

- a primary block is created, without a record of the previous block in it;

- each following block contains information about the “parent”, transaction type, and its header to generate the next block;

- system users see the total number of blocks but have access only to their own.

The *blockchain* can be interpreted as a distributed data technology that acts as a shared database, keeping all its copies synchronized and verified. There is potential for a severe level of trust among its main features when exchanging data (transactions). That is one of the decisive factors that technology can significantly affect the business models in various industries.

The *blockchain* is interpreted as multi-level information technology; the primary purpose is to record various assets reliably. From a technology perspective, the *blockchain* can be interpreted as a chain of data blocks. Conducted transactions in such a system form own new blocks. Such circumstances suggest that *blockchain* is a technology for reliable distributed data storage on all performed transactions. It

should be emphasized that the made record is directly related to the data themselves, which makes the system as non-commutative. At the same time, the blocks store records with all supporting information. The blocks in the system are presented as a single-linked list. A node represents each participant of the system. Besides, any node stores an entire data domain; furthermore, it can communicate with other nodes.

A distinctive feature of the innovative *blockchain* technology, presented as mathematical algorithms and software, is that it does not require the contractors to be involved when concluding contracts, thereby allowing transactions to be made without intermediaries like the state, banks, and lawyers, as well as without charging fees and remaining completely anonymous.

Serious attention now focuses on the *blockchain* technology literature. This circumstance is explained by the possibilities of applying and implementing this system, which is a technological breakthrough. Experts are convinced that the *blockchain* technology introduction in various social spheres can change the world.

Analysis of recent achievements and publications. The reference review provides an understanding of the *blockchain* technology concept from a practical point of view. The review shows that the *blockchain* technology topics on the practical application do not include in-depth subject coverage. *Blockchain* is mainly covered as a general-purpose technology. The paper [2] highlights specific examples of companies applying *blockchain* and showing its value. The more so, it emphasizes that the *blockchain* publications are usually prognostic, where the technology potential capabilities are widely covered, but discussions about how *blockchain* can improve the enterprise's efficiency are still lacking. It can be noted that the focus of the reviewed publications is on what can happen if the *blockchain* is massively implemented at enterprises. Our studies intend to demonstrate how the *blockchain* technology choice can increase enterprise's efficiency and what value it could bring to the enterprise that applies it.

The paper [3] also highlights a shortage of articles that examine the consequences of *blockchain* applications for entrepreneurs in detail, describing their entrepreneurial aspects. Such views are also shared by other researchers [4–5]. The authors agree with the potentially powerful *blockchain* technology abilities and set the main problems for entrepreneurs in the *blockchain* application.

Thus, with such a lack of publications and discussion of entrepreneurial aspects of value creation for *blockchain* companies, the research authors intend to show how the research helps bridge the identified knowledge gap between the potential areas of *blockchain* technology application and the necessary configuration of enterprise resources.

On the other hand, the literature review analysis illustrates that the *blockchain* technology competitiveness is displayed via technology selection. It was revealed that approaches to the *blockchain* technology application could be implemented according to two central schemes: “technology first – problem second”, or “problem first – technology second”. However, the studies proved that enterprises dealing with extensive experience in implementing *blockchain* technology tools, as a rule, operate according to the second scheme. At the same time, the corresponding problem is considered, followed by the process of justifying the solution to the problem through *blockchain*. The researchers note that this is the most effective approach [6–8].

The research purpose and relevance. The research purpose is to bridge the knowledge gap between potential *blockchain* technology application areas and the necessary configuration of enterprise resources. That will allow the company to apply *blockchain* technology as a useful resource for solving problems when increasing the enterprise's competitiveness. The research relevance proves that if an enterprise strives to increase its competitiveness, it should apply *blockchain* technology and other resources.

Such an approach allows considering *blockchain* technology from a strategic point of view for enterprises interested in increasing

competitiveness by this technology. Moreover, the necessary processes for choosing the technology *blockchain* should recognize that it is best suited to solve a specific problem.

Statement of the primary research material. The blockchain features in increasing enterprise competitiveness. The paper [8] notes that *blockchain* technologies underlying the *Bitcoin* do not provide for separate currency information storage. Moreover, it is noted that any information that requires a third party (an intermediary to verify, e.g., a bank) can theoretically be stored in a *blockchain*. This approach allows making it independent of such an intermediary. Based on this, the [9] defines the *blockchain* far broadly and presents it as a value exchange network with serious potential for the information decentralized storage and transmission. Finally, the [10] formulates the *blockchain* features for analyzing its applications in the Chinese stock crowdfunding market. Based on those studies, we may note such technology's main features and make explanations as a comparative analysis.

Distributed ledger software and transparency. A publicly available list of transactions (data exchange) allows each partner in the network to have access to each transaction made, making the system transparent.

Decentralized data management. Each peer user of the system has the authority to add data to the database, i.e., make transactions. That means that there is no user with more system rights than any other.

Data security, protection against unauthorized access, falsification, and data integrity. The *blockchain* has the storing data architecture to be immutable and protected from unauthorized access – the *blockchain*'s decentralized nature makes the system overly complicated by unfriendly users.

High performance. Checking balances and completing transactions in a *blockchain* system could theoretically be instant.

There is no risk of centralized failures. The decentralized information storage system eliminates the risk of data loss and downtime due to a centralized unit (e.g., of a bank).

Flexibility and reliability. Programmable *blockchain* enhances flexibility and reliability in a wide variety of application scenarios.

Inability to make changes to the system by an individual participant, which eliminates fraud. Such an approach eliminates successful hacker attacks on the *blockchain* system.

Lack of intermediaries in transactions. All operations with money, documents, and any critical information are currently performed via intermediaries, i.e., those operations require confirmation by notaries, banks, or government agencies. Unlike the existing practice, *blockchain* technology does not have a central authority, which means that the system participants check all operations themselves, which significantly simplifies the process and eliminates the authorities and credit organizations' need for control. Those are the fundamental advantages of such a system.

However, like any system, *blockchain* technology has advantages and disadvantages that can provoke risky situations. Such disadvantages include the following:

- the ever-growing information volume requires powerful computing tools;
- it is evident that with the introduction of *blockchain* technology to the areas of everyday life will crowd out such specialists as accountants, notaries, etc., with simultaneous demand increase for entirely new professions, i.e., there will be a change in the labor market;
- tax services see the *blockchain* as a way of tax evasion; the central bank suspects that shadow funds are cashing out via cryptocurrency; special services suspect terrorism financing.

Like any innovation, *blockchain* technology generates a mass of disputes. However, researchers agree that *blockchain* technology is one of the essential inventions in recent decades, changing many life areas. This technology has the future.

The *blockchain* technology application. Studies show that hype and a low level of understanding of *blockchain* technology are the main reasons for applying this to many

poorly suited problems or not appropriate. In [6], the author claims that *blockchain* is near the hype cycle's peak for new technologies and indicates that those technology expectations are currently exaggerated. That often significantly slows down many start-up companies with hypothetical cases of *blockchain* application using growing hype for their marketing benefits. Concerning specific areas of the blockchain technology application, literature sources do not indicate which areas are ultimately the best to apply *blockchain* technology, except, perhaps obvious, in currency application cases, as is the case with *Bitcoin*. However, there are many publications today aiming to reflect and list possible application cases for *blockchain* technologies. The author in [7] hardly fully explores such technology's abilities. He claims that there are "potentially countless" *blockchain* applications that underlie its paradigm. On the other hand, a list of software focuses today on the *blockchain* technology application.

Simultaneously, although the lists of application areas may seem very different, there is a consensus about which prominent application areas are based on today's *blockchain* application. Such applications division usually includes four categories. Those four most consistent categories further expand the subcategories creating an ordered list of their application areas. Let us note and brief those categories.

1. Finance. The *blockchain* technologies form a distributed ledger software and various financial services. The main focus is on the original *blockchain* application, the - *Bitcoin*, and an alternative application to create their financial institutions' *blockchain* software.

2. Ownership. The *blockchain* technologies create smart and autonomous ownership software. Intellectual property allows checking, programming, and trading by the *blockchain*, the ownership of its physical and non-physical components. Real-life examples of smart property include vehicles, telephones, and homes that can be activated, deactivated, tracked, and maintained.

3. Law. Here the *blockchain* technologies create programmable and

self-executing contracts. They discussed the concept of decentralized autonomous corporations (*DAC*), decentralized autonomous organizations (*DAO*), providing opportunities for authors to expand ownership. The *blockchain* technology in real estate allows for unprecedented updates on how relevant ownership records are stored and generated.

4. Identity. Here the *blockchain* technologies formulate programmable and self-executing contracts. The concept of *blockchain* identity applications is introduced, allowing continuous ID verification, authorization, and managing contracts that lead to significant process efficiency of real identity and reduction of different fraud.

Implementation of *blockchain* technology in Ukraine. Nowadays, Ukraine partially applies *blockchain* technology at the State Land Cadastre, e.g., the abstract verification process. At the second and third stages of cadastral *blockchain*-ization, the existing database will be transferred to the distributed ledger, followed by hashing all the ongoing transactions. The State register of property rights to real estate is next in line.

Prospects for *blockchain* technology development. As previously reported, *blockchain* technology has several undeniable advantages. Quite interesting prospects appear when such technology is introduced worldwide. Meanwhile, meaning to develop a digital economy inevitably leads to the consideration of new directions.

Blockchain technology allows for solving several significant problems at once. Let us note the major ones:

- a significant time reduction for financial procedures;
- material costs reduction due to absence of powerful servers, expensive complexes for data storage;
- depriving the monopoly of large companies trying to manipulate the market at the expense of large capital.

The digital economy specialists predict exemption from corruption, exclusion of money fraud, and other financial crimes. According to them, the system forces the

transparency of all the users to abide by the law - as any operation is open. Such prospects become critical for the state due to the lack of a legally regulated scheme for switching to *blockchain* technology.

Conclusions

The analysis results of distributed ledger technologies (*blockchain*) application in various spheres of the economy, finance, and social and economic life showed that *blockchain* technology is of undeniable interest. Many financial companies, banks, enterprises, and exchanges announced the formation of special projects for the study and development of such technology of the digital economy. The attention to *blockchain* technology has sustainable increase trends.

However, there are no standards and legal relations in such a technology application; for this reason, some serious market participants have united consortia to form standards for practical implementation and technology application. There have been invested over two billion dollars in the past three years to study such technology and its application possibilities in financial services.

The paper discloses the aspects outlining the *blockchain* as a multifunctional

information system designed to count various assets. There were presented analyses of the technology's significant advantages and disadvantages, which still exist today and demand a separate study.

The paper reveals the prospects for this technology in various sectors of the economy, finance, and others beyond economic areas. Based on the study, the promising areas of technology development in Ukraine and worldwide were identified.

The conducted research also helps eliminate the identified knowledge gap between the potential areas of the *blockchain* technology application and the necessary configuration of enterprise resources. It is also shown that it allows increasing enterprise efficiency by *blockchain* technology and other enterprise resources. Using the proposed approach, when the enterprises apply *blockchain* and other resources to increase their performance, the research authors emphasize the resource configurations' relevance.

The obtained research results show that although the *blockchain* is a resource itself; however, internal and external factors aim to make it a valuable resource for an enterprise.

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