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Blockchain as a Part of the Digital Economy in Financial Sphere

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Abstract

The technology of Blockchain is one of the trends in economics, political and financial spheres. Blockchain is an integral part of the new type of economy - digital economy. In the modern world digital economy, basing on the principles of applying digital technologies, is a key factor for the development of social and economic activity that increases the country competitiveness, quality of the citizens' life, provides economic growth and national sovereignty. Blockchain is the technology that leads the whole digital economy. Currently, the Russian economy is transforming under the influence of Information Technologies. A qualitatively new stage of development has begun, including the creation of a modified system for recording information, blockchain and the formation of cryptocurrency.

Keywords: Blockchain, Cryptocurrency, Digital Financial Services, Digital Banking Services, Online-Banks, Internet-Banking, Remote Service.

I. INTRODUCTION

Blockchain is a multi-level, multifunctional information technology, the purpose of which is reliable (without information leaks) asset accounting. This technology potentially has a huge amount of application fields and covers all spheres of activity. It means that this is accounting in state and private organizations, and transactions with tangible and intangible assets, as well as in relation to economics and finance. Due to the fact that the technology of blockchain is based on the functioning of bitcoin, this technique has been evaluated inseparably from the first cryptocurrency until recently. At the same time, it can be used not only to create digital money, but also for a wider range of actions.

Blockchain is a reliable technology for storing records about all of the previous completed transactions. Blockchain can be characterized as a chain consisting of data blocks. Every ten minutes miners add new blocks with records of last transactions. Thus, the blocks are fixed sequentially in a linear chronological order. When a miner joins a bitcoin network, a copy of the blockchain is automatically downloaded on each computer that is also connected to the network and transfers transactions using a client.

II. METHODS

The methodology of the study is based on the application of classical scientific methods and techniques, namely: systematic consideration of the object and subject of the study, dialectical logic, analysis and synthesis, methods of grouping, comparison, generalization, which allows to speak about the complexity, integrity and reliability of the results of the study.

III. MAIN PART

The main advantages of the described technology is pointed out.

Firstly, blockchain is almost immediately distributed over a huge number of computers. Due to decentralized technology, all entries are available to all members of the same rank. There is no need for authorized bodies and the process goes on without intermediary services.

Secondly, this technology uses cryptography and digital signatures, which is necessary for identification. Due to the availability of cryptographic identification data, one can track

the progress of all transactions. This will be feasible in the case of binding digital data to real identification data.

Thirdly, using their own computers, numerous participants in the chain authenticate and check each block that must join the chain. Thus, it ensures that no transaction is completed more than once. New blocks are accepted only after the consent of the majority of participants to admit them.

Due to the Blockchain technology economic transactions are supported by the technical side. It becomes possible to make instant cash payments in a universal cryptocurrency. With the help of the blockchain, in addition to transactions, monitoring and execution of operations with various assets are also available. In the global scale the registration and accounting of all assets for conducting further operations with them are available without restrictions by the geographic position or the types of participants.

Cryptocurrencies have many features. With this understanding, governments that try to bring digital currencies to existing regulatory standards in the country will need new legislation. The technology of Blockchain allows modifying not only the numerous financial transactions, but also operations with the instruments of crowdfunding, debt obligations, derivative financial instruments and others [5; 8; 9].

So, blockchain is presented as a special type of protected distributed data structure - a database (DB), which without the main administrator and centralized data storage maintains an ever-expanding list of blocks / records and establishes rules for working with transactions / events recorded in blocks and linked to them (unlike ordinary databases, in which rules are often set for the entire database or application).

Such a database is shared by a group of users of the blockchain - nodes- entities in the blockchain network (transport level of the blockchain platform) that receive and process transactions and share information about a potential transaction. The node either proves (public blockchain) or verifies (hybrid / private blockchain) transactions and then adds them to the block with a unique hash code.

Thus, there are two special types: miners and validators. Miners look for new transactions in the system (more precisely, in the corresponding data sources) and cryptographically prove that the transaction is real (valid) for its inclusion in the blockchain as part of new blocks, using evidence-based tools such as proof of work / resource / state / activity and etc., offer them. Validators check series or individual transactions based on appropriate means of checking them (for example, the Byzantine fault tolerance mechanism or "double costs").

A block may include one or more transactions grouped by a specific criterion. The new block is included in the blockchain on the basis of one of the methods used to reach consensus, for example, most nodes that agree that all transactions in it are valid (legal, reasonable) and this correctly created block can be included in the blockchain, Fig. 1.

For the blockchain itself, the history of including blocks in it is also stored in a secure way. This history is used by all users of the blockchain and is unchanged and verifiable to record transaction history, for which various protocols are used.

In a publication, a transaction is a record of the movement between the interacting parties of assets, for example, digital money, material assets, etc. A transaction can be an account verification event, generated each time the money is deposited to or withdrawn from a current account [11].

As noted above, each block in the blockchain may contain one or more transactions. Consider an example of invoice processing.

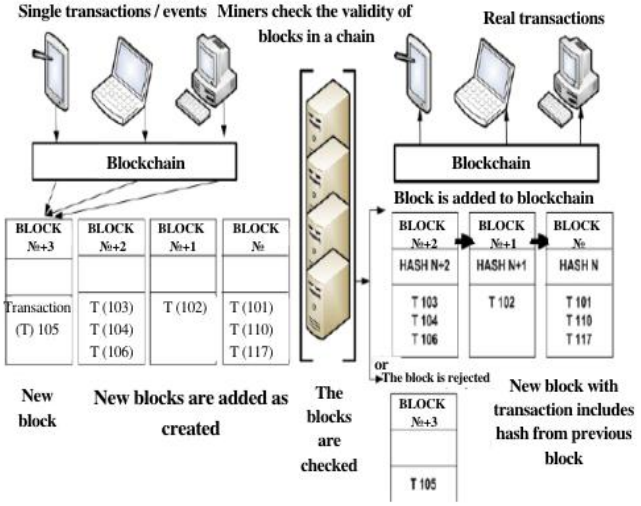

Fig. 1. The inclusion of a new block in the blockchain

A separate transaction, as a rule, includes the following information fields (although there may be more):

- Amount - The total amount of digital assets held for movement;
- Input - A list of digital assets to be transferred (their total value is equal to the sum). In addition, each digital asset has a unique identifier and may have a different value from the value of other assets.

Assets themselves cannot be added or removed from the list of existing digital assets. But digital assets can be divided into several new ones (each with a lower value) or combined into a smaller number of new digital assets (each, respectively, with a higher value);

- Output - Accounts to which digital assets are transferred.
- Transaction identifier / hash code - A unique identifier for each transaction. In some versions of the blockchain, identifiers are used, while in others, the hash code of a particular transaction is used as a unique identifier.

An example of the operation of blockchain technology on the example of the use of cryptocurrency, Fig. 2.

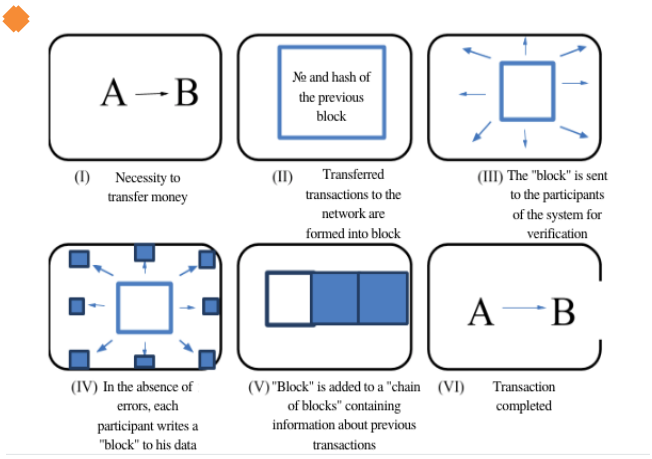

Fig. 2. Example of blockchain

The other example is the use of blockchain for maintaining a home book. In one block, the state of all apartments in an apartment building at once or, more reasonably, only one apartment can be recorded and then the chain when changing the information on one apartment can be changed. A new block is created only when the state of any apartment changes, for example, the change of residents. For this example, the transaction should include the transaction number, apartment number, date of a change in the composition of tenants, the basis for changing this composition and a new list of tenants of the apartment with their settings (last name, first name, middle name, date of birth, etc.) and, possibly, other metrics [12; 1].

In order for the information in the blockchain to be processed quickly, one needs to optimize the size and composition of the fields included in the description of one transaction.

It's not necessary to put the contract itself to the block, since in many blocks it will be the same. Only the number of the contract and the corresponding checksum (the checksum of the text file with the contract) needs to be specified, which in the protected blockchain must exactly match its appearance at the time the block was created. In the case of working with contracts at different stages of the life cycle, transactions are different: at the stage of development and approval - who made it and when, what changes, at the stage of transaction execution reflects a certain sequence of actions, at the control stage - the degree to which the real situation meets the requirements of the contract and etc.

An example of transactions description of the blockchain used in managing information security incidents.

When managing information security (IS) incidents in a network of organizations, it is required to maintain a sequence and description of all IS events that occurred and led to the incident [7].

An IS event is the identified occurrence of a certain state of an organization's asset (system, service or network), indicating a possible violation of the IS policy or protective equipment operation violation or the occurrence of a previously unknown situation that may be related to IS [10]. An IS incident is the occurrence of one or more undesirable or unexpected IS events that have a significant likelihood of compromising business operations and indicate a completed, attempted, or probable implementation of an IS threat to an organization's assets.

IS events can be considered as part of an IS incident, and the IS incident itself as a set of IS events.

With this formulation of the problem, a closed (within the same organization) blockchain is an ideal means of storing IS events in a network environment, since the blockchain records and builds them in strictly chronological order.

Thus, in this case, the blockchain can be considered as a unidirectional (without feedback) data structure (chain) with a linked list of blocks, each of which refers to the previous one, using hash codes-pointers stored in the block header. One block with a unique identifier and a cryptographic link to the previous valid block combines transactions - information security events belonging to the same information security incident (as its successive steps) [6].

The format of the IS event record in the block can be taken from one of the IS incident description specifications currently used by network security tools vendors. Most often, these are the specifications of the MITRE Cyber Observable eXpression (CybOX) [2], Structured Threat Information Expression (STIX) [3] or Trusted Automated eXchange of Indicator Information (TAXII) [4], developed in 2013.

Creating a blockchain containing only IS events from reliable data sources fits well with blockchain technology (hereinafter BT). One block contains one suspicious event, one IS event, or consists of several IS events.

The widespread and advertised by various manufacturers options for implementing blockchain technology do not yet have a single standard (set of standards). It is important to understand that these technologies do not form the basis for the construction of an automated information system (AIS), but only allow creating its constituent element, ensuring the immutability of registers in which certain actions are recorded (for example, the fact of concluding a contract and its most important details, purchase, indicating the amount and product identifier, etc.) and the system is created to support these actions.

Let us consider the main directions of the blockchain technology development in PAO Sberbank. At the end of 2015, the Bank launched the project on the Ethereum platform. In 2016, Sberbank took part in blockchain development consortia, the first international transaction was made through a platform based on this technology, and the bank conducted the first transactions between banks using the prototype blockchain service. A decentralized approach to blockchain technology allowed the exchange of information about fraudsters between banks in 2017. Sberbank Factoring and M.Video companies had verified deliveries through the blockchain. Also, this year, the concerned technology was used in escrow, the currency was exchanged through tokens

and the first payment blockchain transaction in Russia was made.

In January 2018, Sberbank of Russia launched the blockchain laboratory. The main directions of the innovation laboratory are:

1. Research of the latest technologies and platforms based on distributed registries;
2. Formation of ideas for business development based on blockchain technologies;
3. Product prototyping;
4. Conducting pilot projects;
5. Implementation of applied business solutions.

Table 1 presents examples of the application of blockchain technologies in business according to the laboratory of PJSC Sberbank of Russia.

Table 1. Examples of using blockchain in business

Business sphere	**Blockchain application results**
Financial markets	Creation of a new infrastructure for the issue and circulation of securities.
Banking	Simplification of payments and their tracking, release of digital currency.
Production	Improving the speed of supply of raw materials and the quality of service due to quick exchange of information with suppliers.
Public administration	Maintaining transparent government digital registries and processes to reduce the level of corruption.
Medicine	Simplification of storage and sharing of medical data, clinical trial management, drug labeling.
Insurance	Creation of general insurance funds (P2P), maintaining a register of insured property, providing comprehensive coverage of risks, more accurate calculation of losses.
Retail trade	Exchange of information with suppliers, creating token-based loyalty programs, tracking the origin of food products and art objects.
Logistics	Maintaining transparent digital workflow, tracking the supply and origin of goods.

Source: the table was compiled by authors independently

According to the director of the Innovation Development Center of AO Alfa Bank, the main directions of development of blockchain solutions are:

- Insurance sector;
- Retail leasing;
- Profitable property;
- Travel business;
- Vertically integrated structures.

AO Alfa-Bank is one of the first banks in Russia to launch the development of blockchain technologies for business. At the end of 2016, Alfa Bank and S7 Airlines conducted the first letter of credit transaction in our country using smart contracts. According to data for this year, the volume of payments for the sale of tickets through the blockchain platform exceeded $ 1 million per month. The use of innovative technology allows one to simplify and speed up calculations and reduce traditional paper workflow, while maintaining the safety of operations.

Over the next year, the bank introduced blockchain solutions for business processes optimization: automating trading operations with S7 Airlines, creating an open platform for supply verification in factoring with the participation of M.Video and Sberbank Factoring. A joint project of Alfa-Bank, Sberbank and MegaFon carried out the first blockchain-based payment in Russia.

In the fall of 2019, Alfa-Bank, together with X5 Retail Group, launched the custom service Distributed Treasury and Cash Management (DTCM), which allows bank customers to manage payments, credit and deposit products, as well as a system for efficient liquidity management within the holding. Using this service, corporations make the transition to a service model of interaction with the bank - Bank-as-a-Service (BaaS). The BaaS model allows one to bring the business logic of banking products outside the bank, adapting to the needs of the client.

The implemented experience proves that the financial market and large businesses are ready to introduce blockchain technologies to their activities. At the same time, this is not only a current trend, but also a real tool for optimizing and reducing costs in companies.

IV. SUMMARY

At present, blockchain is a multi-level, multifunctional information technology designed to study assets in the financial sector. This technology potentially has a huge number of fields of application and covers all areas of activity.

This is an accounting in state and private organizations, and transactions with tangible and intangible assets, as well as in relation to economics and finance. Due to the fact that the technology of blockchain is based on the functioning of bitcoin, this method until recently has been evaluated

inseparably from the first cryptocurrency. At the same time, it can be used not only to create digital money, but also for a wider range of actions.

V. CONCLUSION

This work examines the block chain as a part of the digital economy in financial sphere. Blockchain is a technology that combines a number of mathematical, cryptographic and economic principles that support the existence of a distributed registry among several participants.

Features of the technology are the impossibility of changing or falsifying data, the transparency of transactions, decentralized data verification, redundancy of network nodes and the features of verification using digital signatures.

Thanks to blockchain technology, economic transactions are supported by a new technical side. It becomes possible to make immediate cash payments using a universal cryptocurrency. With the help of the blockchain, in addition to transactions, monitoring and execution of operations with various assets are also possible. On a global scale, without restrictions on geographical location or type of participants, registration and accounting of all assets for further operations with them are available.

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