

Opportunities for the introduction of smart contracts in the agro-industrial complex of Russia

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Abstract — Many advanced technologies appear in the period of digitalization of economic processes, in particular, one of these technologies is the blockchain. The application of this technology is used in many areas: information technology, law, state, and municipal administration, etc. This article discusses the mechanisms of functioning and features of the latest Internet technologies in the context of the agro-industrial complex of Russia. Their practical significance for optimizing the relationship between the seller and the buyer has been investigated. The advantages of the blockchain for all market participants when using technology in the supply of agri-food products are justified. The research shows the possible difficulties and shortcomings of the existing content system, gives recommendations on the use of the blockchain and its evaluation for domestic producers of agricultural products. The authors propose a mechanism for using the blockchain technology in agriculture, which will change the existing practice of trade and settlement transactions between counterparties of the agricultural market.

Keywords — *blockchain, agriculture, digital economy.*

I. INTRODUCTION

Progressive technologies associated primarily with the use of the latest information systems are developing very quickly and are being introduced in the modern world. Recently, such phenomena as cryptocurrency and the smart contract, functioning thanks to the blockchain technology, have become very popular.

Starting from experimental use by single developers, they quickly gain recognition in operations between business representatives and at the state level. Agriculture, despite its low adaptability to progressive changes, also has the opportunity to reach a qualitatively new level in organizing the promotion of products from the producer to the final consumer. The technology of “blockchain” in many ways helps to solve the rather actual problem of real compliance of products with the stated safety and quality indicators, which are not always possible to check in time.

II. MATERIAL AND METHODS

Over the past 50 years, the development of information technology has passed several defining stages - each has consistently become an event of the decade. In the 1970s, it was the use of large universal servers (mainframes), in the

1980s - the invention of personal computers (PCs), in the 1990s the Internet was booming, and the 2000s were influenced by the global spread of mobile devices and the active use of various human devices social networks, and the 2010s (now) are taking place in conditions of extremely rapid development of cryptocurrency and related technologies [1].

In a broad sense, “blockchain” (from the English. Blockchain: block - “block”, chain - “chain”) is a way to store data, or a digital registry of agreements, contracts, transactions (transfers). For example, it may be information on bank deposits, property rights, census population, etc. That is all that requires a separate record and possible verification. The main feature of the technology is the presence of distributed storage (on many computers), and not on a single server. In practice, this means that the database contains information located on thousands or even millions of computers around the world. Any user of such a network has access to the current registry. In addition, participants in transactions are completely independent in their activities from intermediaries (in particular, banks). The principle of operation of the blockchain technology involves the integration of digital records into blocks that are encrypted and placed in chronological order using mining - solving relevant mathematical problems by computer miners [2].

At the same time, each next block is connected with the previous one by generating hashtags for each entry (figure). Each new entry contains a hashtag pre-entry. The first record of such a chain is called genesis, new blocks are added only at the end of the chain. Encryption is performed by many computers on the same network. After the calculations, the block is assigned a unique digital signature - a hashtag. It can no longer be changed after updating the registry and creating a new block.

Therefore, it is almost impossible to fake it but only add new entries.

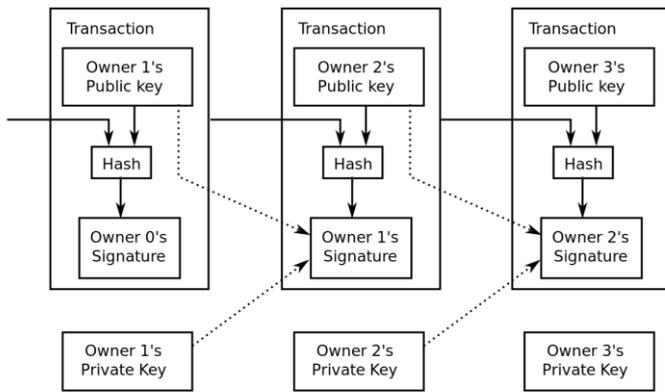


Fig. 1. Blockchain operating principle

The registry is simultaneously updated on all computers in the network. The probability of hacking the system by hackers is low because the process of encryption by participants is irreversible [3].

Another digital signature will be obtained when changing the initial information in the block. This will indicate a discrepancy in the system and, as a result, such a block will not be included in the blockchain, which makes it impossible to use the same amount of money for two different operations.

III. RESULTS AND DISCUSSION

Users of this technology decided that it is capable of more than just storing information. As a result, the blockchain began to be used when entering into smart contracts [5]. The smart contract in the blockchain is present in the form of a computer program. It is intended for the conclusion and execution of self-securing contracts. Smart contracts are recorded in code form and maintained by a network of computers. It can independently carry out transactions according to the prescribed options without the services of typical intermediaries - banks, government agencies, or at the command of an agent who has the authority to do so. Blockchain provides several extremely significant features in the course of activities for agricultural production, without which it is impossible to imagine the organization of the trading process. Firstly, it confirms the authenticity of the product origin, serves as a guarantee of the process transparency for consumers. Secondly, it significantly speeds up settlement and payment operations and reduces the commission benefit of intermediaries. Thirdly, it provides real-time control of the programmed process. Consumers are often willing to pay extra for the uniqueness of the product (the use of a unique cultivation technology, non-use in the production of harmful substances, forced labor, minors' labor). The technology of "blockchain" makes it possible to confirm this by tracking all the processes that occur with products [4].

Now the exchange of physical goods is separated from the exchange of payments. In other words, farmers often supply their crops, but then they have to wait weeks or months to get paid. Farmers do not have the ability to conduct a proper

inspection of the buyer, so buyers can compete on the terms of payment, and therefore, offer lower purchase prices. Manufacturers also actively cooperate with large transnational corporations and state-owned companies that have less risk of default. Blockchain can change all this because it allows you to pay in real time when delivering goods. As a result, agricultural producers receive funds immediately, industry competition increases, prices remain stable or grow, and buyers save time and money (win-win situation). Adding transparency, trust, and efficiency to the calculations can reduce the risk and unlock new financing mechanisms for banks [5].

In agricultural production, interest in the "blockchain" is due to its usefulness for various market agents [6]. In particular, manufacturers are usually not interested in using environmentally friendly and expensive technologies because consumers do not have access to the entire supply chain when forming the final product, so the added value does not eventually become known to the consumer, and therefore does not become monetized. However, the above mechanism is able to effectively solve this problem. The blockchain also makes it possible to reduce the number of intermediaries from producer to consumer due to the transparent fixation of all transactions in the logistics chain. Also, buyers for products that are willing to pay the additional cost, generated through the use of more expensive technologies and implemented as quality, are quickly found [7].

Distributors usually receive only unconfirmed assurances from manufacturers about the quality of products, technologies that were used, the harvest. However, they are interested in receiving accurate information about the origin of the product, as they risk their finances when there is a change in supply and demand. The main advantage of the "blockchain" for these subjects of the market, which creates monetization opportunities, is new data that were not available before (how much and what kind of fertilizer was used, whether the plants were sick, what was the yield, what methods of precision farming were used). Such innovations will radically change the existing practice of agricultural entrepreneurship. Distributors and brokers are critical elements in the adaptation of blockchain technology. They will definitely use this technology and not oppose its introduction, as they will understand the benefits. Buyers who require proof of the origin and quality of products from distributors will be the driving force behind the adaptation of blockchain technology to food suppliers.

Food processors often suffer from insufficient information to verify the origin of products (for example, hormone-friendly chickens). The credibility of a processor's products depends on its ability to provide information not only about the nuances of its own processing but also about the origin of the product. This requires information about the entire production process from the manufacturer (farmer) [8]. Recyclers must economically motivate the manufacturer to provide such information themselves. They do not want to share information about the processing technology, so the

“blockchain” will enable them and manufacturers to exchange information confidentially, at the same time allowing the technology to verify the accuracy of the data automatically. For example, a vegetarian restaurant that sells hamburgers. The restaurant buys hamburger buns through the “blockchain” at the bakery. The bakery uses the “blockchain” for publicly stating that it bakes buns that meet vegetarian standards. The restaurant sends a smart contract that identifies the bun conformance to vegetarian requirements. The bakery in private mode provides a list of ingredients for smart contract verification. Looking through this list, a smart contract can certify a bun for use. The smart contract continues the certification process for each new order.

Large manufacturers can start adapting the blockchain technology from pilot projects, for example, for organic products, over time adapting it to other brands.

Trading networks are under competitive pressure from online merchants. The largest networks cannot logically substantiate premium prices for products to customers, which require greater transparency of information about products. Trading networks could benefit, if they had sufficient evidence that the products are truly organic, local origin, purchased on the basis of fair trade, using integral pesticide management. Blockchain allows the buyer to obtain and verify such information.

This is an effective way to raise low consumer confidence in the beliefs of retail chains regarding the quality, origin, and freshness of their products. Nutrition has a direct relationship with consumers. The current trend in providing the consumer with expanded information about the product (in particular, the meat of animals that were on the run) continues to grow. Online ordering and software for smartphones also increase the requirements for the quantity and quality provided.

Consumers are willing to pay significant bonuses for food that is truly beneficial to them. High - class restaurants are on the way of supply under the "farm-fork" scheme, but there are not enough of them to adopt the "blockchain" technology. Medium-sized food supply chains, which receive additional premium money for the quality and environmental friendliness of their products, will sooner or later face the problem of identifying products as the best on the market.

In the operation of this technology, there are several important points. "Blockchain" can be introduced in stages [9]. Optionally, all participants in the product supply chain must participate in it. This situation is not realistic. Of course, the gaps in the network hide information that has acquired great value if it were presented in the blockchain. For example, the catering service and the local farmer are interconnected with the “blockchain”, but the delivery company is not a member of a common technology for both. During harvest, the farmer provides information about the growing process, date of harvest, etc. The company transports products with delivery. The next starting point in the blockchain will be the point when the restaurant receives the product [10].

The smart contract of the restaurant sends the farmer the information that the product has been received. The lack of information during transportation is a “blind spot”, but it does not prevent to get the benefit from the functioning of the “blockchain”. The large role of the blockchain food is in the evaluation by participants of the network of judgments made by other participants [11]. This information is very important to the buyer. The company goes beyond the traditional designation of the product and the digitization of data giving certain statements in the "blockchain." This can already be used in other automated systems, such as smart menus, diet planning programs, purchasing managers, etc. The processor in this matter can go further by inviting verification of product samples. If the products do indeed comply with the previous characteristics on demand, the certification center may place the certificate on the blockchain, providing the data from the processors. Food Blockchain always requires new content. However, not all information in the system is publicly available. Information about the owners, as well as methods, measurements, recipes and other important information can be distributed through closed channels between selected participants. For example, the smart contract of a vegetarian restaurant has access to a list of bakery bread ingredients to certify compliance with vegetarian requirements. A person does not get access to the list, only a smart contract whose coded instructions are open to all participants of the blockchain technology. Thus, with the widespread use of blockchain by business entities and the many-valued utility, it is possible to argue about the functioning of the smart market. The greatest application of technology is observed in a dynamic market, based on data with a live mechanism for attracting participants, when information can be a major asset.

Having such a data tracking mechanism, it is no longer necessary to wait until some large distribution network or another company applies new standards.

Smart contracts can evaluate approval and tell owners whether compliance is achieved in quality, time, quantity, etc. The main positive aspect of the blockchain is that, as part of the market infrastructure, it allows transactions between players who do not know each other or do not trust each other, as well as conduct transactions using smart contracts.

With all the obvious advantages of blockchain technology, there are also risks and disadvantages of use. Many nuances have not yet been taken into account in the regulatory sphere; it’s not easy to tie digital data in real economic conditions. Of particular concern may be the protection of a specific smart contract code. These features are still responsible for the non-proliferation of such contracts in everyday business life.

IV. CONCLUSION

Despite the dominant role in exports, the agrarian industry is generally technically and technologically backward, as evidenced by the raw material orientation. The use of information technology is rather limited or absent in many areas of domestic agricultural production. Our country is

inferior to the leading agrarian exporters of the world in this direction - the countries of the European Union and the USA, which earn on the global supply of value-added products.

The blockchain technology allows optimizing and simplifying the process of moving products from the place of production to the place of consumption, to monitor the cultivation, collection, processing of the product and calculations for it in real time. It has obvious benefits for all participants in the food supply chain. This technology, having passed the necessary approbation in various sectors of the economy, is quite capable of becoming habitual not only for Russian agroholdings but also for small farms engaged in the production of specific or organic products.

Now information about the blockchain is worth spreading among our manufacturers for a clear demonstration of practical use. Based on this, the final decision on economic feasibility will be made. The blockchain under favorable conditions can be a powerful factor in the accelerated development of agriculture in the Russian Federation.

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