

MATHEMATICAL SCIENCES

BLOCKCHAIN FOR SUSTAINABLE DEVELOPMENT

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Abstract

The article is devoted to the study of the possibilities of using blockchain technology to achieve the Sustainable Development Goals. It substantiates the importance of such qualities of technology as decentralization, confidentiality and identifiability, transparency and security of transactions. The prospects of blockchain technology application for solving environmental and social problems, the development of health care and education are discussed.

Keywords: Sustainable Development Goals, blockchain technology, areas of use.

Introduction. At the end of the 20th century, the world community realized the seriousness of global problems and the impossibility to solve them by individual countries has led to the concept of sustainable development. Sustainable development - an alternative to the catastrophic scenario of the global world. The concept is based on the idea of harmonization of environmental, social and economic needs of people on the basis of development of their culture, to meet their needs without degradation of the natural environment.

The concept of sustainable development is based not only on the theories of ecology, sociology, economics, but also on the mathematical theory of sustainable systems with feedback, general systems theory and cybernetics "as the art of creating equilibrium in a world of limitations and possibilities" (Norbert Wiener), mathematical models of forecasting biosphere processes [1,2].

The conceptual foundations of sustainable development were considered at the international conference on environment and development in Rio de Janeiro (1992) and summarized in the Agenda 21. Subsequently, they were specified and specified at numerous world forums of the UN and UNESCO. In 2000 the Millennium Goals were formulated, and in 2015. - 17 Sustainable Development Goals.

One of the most important conditions for achieving the SDGs is the informatization of all spheres of society, their digital transformation. A special role in achieving the SDGs can be played by the use of such an innovative management tool as blockchain [3]. It is associated with the creation of modern infrastructure and effectively functioning state institutions.

Blockchain is a technology that provides users with secure transactions in real time in various sectors and industries. It gives a reduction in financial and time costs, simplifies administrative processes, provides transparency, sustainability, decentralized execution of software, and solves the problem of the "deficit-to-trust syndrome". Blockchain is virtually impossible to destroy or hack.

The purpose of the study was to justify the possibilities of using blockchain technology for the Sustainable Development Goals (SDGs).

Results.

Environmental issues. The environmental component is present in all SDGs, but SDGs 6,13,14,15 relate directly to solving environmental problems of clean water, preservation of land and water ecosystems, and combating climate change.

The PwC Audit Advisory Network and the World Economic Forum presented a joint study of blockchain technology for solving serious environmental problems, naming more than 65 applications. These are combating climate change, saving from natural disasters, preserving biodiversity, clean oceans, clean air, resilience of settlements to changing weather conditions and natural disasters.

The concept of a "responsible blockchain ecosystem" has been introduced, which can provide decentralized management of natural resources, create supply chains to increase ecosystem resilience, and leverage the finance needed for "low-carbon and sustainable" economic growth. An example of blockchain technology acting to solve environmental problems is the Power Sharing startup launched in Japan with Softbank and Tokyo Electric Power Corporation, aimed at using blockchain technology to reduce carbon dioxide emissions [4].

In 2017, a discussion was held at the Climate Forum on "Blockchain in the economy, ecology and energy of smart cities. Based on Ethereum blockchain, the WePower platform was presented, which allows trading of clean energy, enabling energy suppliers to cooperate with buyers and investors directly, offering favorable conditions for consumers. The project already has agreements with major producers of "green" energy, the support of the UN and the governments of several European countries. The carbon market is a space to reduce greenhouse gas emissions. Blockchain allows managing carbon credits and creating opportunities for carbon credit transactions. Carbon units represent audited climate system mitigation results. The basis of green bonds is a commitment by businesses to spend the borrowed money on environmental upgrades. State and international taxes and quota systems regulate harmful emissions. This is how a market of environ-

mental financial instruments is formed, aimed at reducing the burden on the environment. Blockchain technology is ideal for increasing transparency in the market of carbon units, and therefore the project "Blockchain Ecosystem" is significant for the global market and has great potential [5].

Social issues. Sustainable Development Goals such as SDGs 1 (eradicate poverty), 2 (eradicate hunger), 3 (good health and well-being), 4 (quality education), 10 (reduce inequality), 11 (sustainable cities and human settlements) are dedicated to solving social problems. The social aspect of using blockchain technology is very broad.

The main qualities of blockchain, determining its possibilities when applied in the social sphere:

- accessibility (possibility of use whenever and wherever there is an Internet network; absence of a permanent administrator; complete absence of interruptions in operation; absence of any technological failures);
- Independence (no intermediaries such as lawyers, notaries, payment systems or banks);
- security of records which cannot be deleted or falsified;
- the acceleration of money transfers and payments and the reduction of their cost;
- reduction of information transfer costs, reduction of system risks in operating activities (for example, the integration of "IC: Enterprise" payment systems with blockchain allows to replace all paperwork of drafting contracts with several "smart contracts", which will be automatically executed when the conditions laid down in them are met).

Blockchain in food production will ensure its transparency and security from growing raw materials to appearing on our table. This is already being used in countries such as Ireland and Italy. The system helps improve the efficiency of customs processes in international transportation of perishable goods (Israel and Singapore). The use of blockchain is able to eliminate any "paper" barriers in the international supply chain, reduce time parameters, and therefore increase the freshness of the products delivered.

The introduction of blockchain technology into the socio-economic system inevitably opens society's eyes to some negative trends in social development: unmotivated emission and unsecured money supply; market speculation; parasitism of the banking system with usurious interest; financial system support of degradation processes (alcohol, tobacco, drugs, crime). Blockchain control of the expenditure of funds makes it possible to ensure that they will not be spent to the detriment of society or inappropriately (for example, when an organization, having received a loan, instead of delivering the necessary goods, simply withdraws the money abroad) [6].

The application of blockchain in healthcare can create a large database of patients, medications and medical services, which includes the competencies of doctors; a bank of medical developments; information on the quality of pharmaceuticals. Blockchain will make it possible to create histories of doctors' appointments; to ensure the confidentiality of patient histories

(since only the doctor and the patient have the cipher to access it); and to share experience in the treatment of a particular disease. Blockchain is an effective tool in the fight against counterfeiting in the medical field: it makes the movement of counterfeit products (counterfeit medicines) in the pharmaceutical industry transparent.

The consequence of blockchain in healthcare will be that the number of drugs will be determined by the real need for them; all drugs will reach patients; "underground" drugs and "gray" schemes of their sale will disappear; the need for development of this or that pharmaceutical product will be clearly visible. There will be a significant saving of time for doctors, hospital staff and insurance medicine; it will be easier for people to receive medical care on vacation or when traveling; there will be no problems with the loss or damage of the MHI policy [7].

Blockchain has proven to be a pandemic-saving technology. In the United Arab Emirates, for example, digital identification of official IDs and other documents has been implemented in a pandemic.

In the future, it will be possible to conduct elections on the basis of such technology without fear of falsification, because one of the main properties of blockchain is that the data once entered cannot be deleted, replaced or erased. This is ensured by the use of special encryption algorithms that guarantee its security.

Blockchain has great potential in the field of education as well. This technology can significantly improve the quality of educational services not only at the country level, but also cross-country and, in the future, facilitate the seamless exchange of information, technology and pedagogical methods at the global level to achieve Sustainable Development Goal 4 as a tool for addressing all 17 Sustainable Development Goals. Attention to the problems of using blockchain technology in the educational system is due to its ability to collect information, store it in an unchanged form, control the reliability of data, create rules and methodologies for management activities, eradicate fake diplomas [8].

Conclusion

Centralized models have long been the main way to manage society. But technology has advanced, with the rise of the Internet and many other tools, including blockchain, that not only span global spaces, but can also provide better coordination of social development, accelerate progress and create a sustainable society. The process of promoting decentralized technologies such as blockchain, AI, and Big Data has the potential to make the society of the future a human society. Blockchain in the next 10 years can change the model of the world economy: reduce to a minimum the speed of any transactions, reduce the cost of conducting them to zero, make the flow of money transparent to society, ensure the achievement of sustainable development in the directions: planet, people, prosperity, partnership, peace. Over time, it seems that it is decentralized solutions, transparent and secure, that will make it possible to plan, on a permanent basis and in the long term, for the sustainable development of society.

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