

## MANAGEMENT CONTROL AND MODERN DECENTRALIZED TECHNOLOGIES

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**Abstract.** Modern decentralized technologies, such as distributed registries, blockchain, smart contracts and decentralized autonomous organizations (DAO), are becoming more popular every year. Therefore, *the subject of our research*, the results of which are presented in this article, is the processes of digitalization in the field of management control and key technologies that allow to organize an effective system of management control in a decentralized organization. The success of management control is determined not only by its ability to identify and correct undesirable deviations in a timely manner, but also by the presence of a special corporate culture based on trust and fairness. Moreover, a positive corporate culture reduces the need for a number of control procedures designed to compensate for the lack of trust within the company. This effect can also be seriously enhanced by modern digitalization technologies. The *research methodology* included a broad review of literature sources and a comparative analysis of modern concepts of decentralized management, as well as drawing conclusions about promising ways to evolve management control systems. The *aim of the study* is to identify the impact on management control systems of modern technologies such as blockchain, smart contracts and decentralized autonomous organizations. The authors summarized the experience of applying these technologies in management control systems, which are designed to ensure high individual and team performance to achieve the strategic goals of the company. The *conclusion* is that the blockchain-based decentralized autonomous organization (DAO) is changing the forms and methods of management control, increasing the role of collective decisions and opening the way for employee initiative. DAO can significantly reduce internal and external transaction costs, including costs associated with the management and operation of management control systems. Different procedures for approval, confirmation and verification, as well as the adoption of standard management decisions are unified and automated. Accordingly, the time and the total amount of effort spent by managers to perform routine actions related to monitoring and control of employees' actions is reduced. Decentralization of control also reduces the impact of administrative procedures and ensures a higher level of trust within the organization. The decentralized model of management control is relevant for various areas of business and management, but special prospects can be seen in the field of decentralized finance (DeFi), where a wide range of professional controllers and users can be involved in auditing smart contracts and identifying shortcomings in financial services.

**Key words:** management control, blockchain, smart contracts, digitalization, decentralized autonomous organizations.

**JEL Classification:** M11, M15, D20

### 1. Introduction

Management control is one of the categories difficult to be defined clearly. Firstly, it is closely related to the

methods of planning and monitoring the activities of an enterprise, such as budgeting and costing. Secondly, its task is to measure performance and to assess the degree

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of achievement of the set goals, both organizational and individual. Thirdly, management control takes care of the creation of effective levers of motivation, which ensure the maximum effective fulfilment of priorities by employees directly related to the implementation of the organization's strategy.

Such multitasking allows us to consider management control, on the one hand, as a conceptual "umbrella", which combines various activities of managers in the organization, especially those related to the planning of operations and monitoring their results (Euske, 1984), and on the other, as an important element of a corporate culture focused on delivering significant results for the organization (Redchenko, Voronko, 2015).

Management control in its modern sense can be described as a process, in which managers form the prerequisites and the mechanism for ensuring high individual and team performance to achieve the strategic goals of the organization. This definition details and develops the opinion of Robert N. Anthony, according to which management control is to exert managers' influence on other employees of the organization in order to implement its strategy (Anthony, 1988). The success of such control is determined not only by its ability to detect and correct undesirable deviations in a timely manner, but also by the presence of a special corporate culture based on trust and fairness. Moreover, a favourable corporate culture reduces the need for a series of control procedures, which are to compensate for the lack of trust within the company.

## 2. Analysis of recent research and publications

The concept of trust as the basis of effective management was scientifically developed in the early 1970s by such well-known scientists as C. Clifford, M. Deutsch, D. McGregor. The process of building trust-based relationships is closely linked to the quality of internal communications within the company, the results of employees' individual experience in developing relations with others (Clifford, 1971), and the need to take risks in order to achieve the goals set (Deutsch, 1968). Trust can be seen as an anticipation that the people we depend on will live up to our expectations (Shaw, 2000), as well as a prerequisite for the constructive and productive work of groups and teams.

The balance of control and trust is important in managing business organizations. This problem has been considered in the scientific works of such researchers as L. B. Cardinal, Søren Jagd, Chris P. Long. These authors argue that managers try to strike a certain balance between trust and control, that is, to create a reasonable mix of control measures on the one hand, and efforts to create an atmosphere of trust and justice on the other. Such a balance strongly depends on the organizational context – on internal and external factors

and requirements that exist in certain companies. At the same time, the main task of management control in any company is to create such conditions under which the achievement of the necessary (target) results by executives is ensured with minimal use of the levers of formal power. This allows the managers to reach a level of interaction with employees, when the imperative of coercion is replaced by the imperative of trust, and administrative control gradually evolves towards self-control.

At the same time, the level of trust in business organizations is not always high enough to effectively solve numerous management tasks. With the advent of modern technology, some authors have argued that a lack of confidence in business and society can be offset by tools such as distributed data registers (ledgers) and blockchain (Lansiti, Lakhani, 2017). But the effects of these technologies on modern systems of management control are twofold: on the one hand, new opportunities for human interaction and confirmation of operations occur, and, on the other, threats of over-decentralization of control emerge. These and other problems of the development of management control along with the introduction of new technologies and digitalization remain insufficiently covered in the foreign and domestic scientific literature.

Therefore, the purpose of this article is to investigate the impact on management of modern technologies such as blockchain, smart contracts and decentralized autonomous organizations.

## 3. Digitalization and blockchain technology

In the recent past, people saw digitalization solely as an opportunity to improve or speed things up: computers had to do the same operations as humans, but more efficiently, better and more accurately. Today, we witness machines, which not only gradually take on those functions traditionally performed by humans, but also demonstrate the capacity for self-learning and development (AI – artificial intelligence) and interaction without human participation (IoT – Internet of Things).

Industrial, household and software work (Internet bots) are being implemented rapidly and they are successfully performing routine operations of varying complexity. According to the International Federation of Robotics (IFR), worldwide sales of robots have increased by an average of 19% annually between 2012 and 2017, peaking in 2017 when sales increased to 30% (Executive Summary World Robotics 2018).

In the field of business, digitalization not only determines the automation and robotization of production processes, but also profoundly alters business procedures, internal communications and managerial decision-making technologies. In addition, digitalization requires a fundamentally different approach to data collection and processing. Even

today, a large number of companies accumulate data not because they have a clear idea of where, how and when they can be used, but simply because the data are “collectable”. The information systems of such companies are full of reports and messages that no one uses to make management decisions. Digitalization does not recognize this approach: the company should collect only the data that are used in the costing process. Sifting through a multitude of information messages, the system selects and leaves only the information that is relevant to the specific goals, and then organizes it, analyzes and converts it into a format of recommendations for managers and other responsible persons. As a result, for corporate management decision-making, companies are progressively using real-time systems that can support the development of detailed scenarios and business forecasts.

With growing volumes and complexity of information used to make managerial decisions, the problems of security and trust are increasingly acute. The more participants are involved in communication processes and in the preparation of business information, the more difficult it is to ensure the protection and accuracy of this information. It is in the use of distributed ledger technology (DLT) and blockchain that today scientists and practitioners are looking for solutions to this contradiction.

Since blockchain technology was first introduced in 2008 by its anonymous developer, hiding under the pseudonym of Satoshi Nakamoto, and then used to create the first cryptocurrency, the bitcoin, a number of progressive solutions for business, finance, government and etc. have already been created on its basis. The attention paid to this technology is largely due to the fact that the participants of the blockchain-based network do not necessarily trust each other. The distributed ledger technologies, on which the blockchain is based, allows transactions to be made, with almost absolute certainty that no one will be able to tamper with records or make any unauthorized corrections.

This dramatically alters traditional approaches to verifying electronic documents: for example, when dealing with asset transactions, blockchain allows a full, automated audit of all transactions to recognize an entity's control over an asset. Such verification is accomplished by building and storing the source information of any asset in the blocks when each digital transaction leaves a unique record in the database, creating the ability to audit any digital event in the past. Such a record is made in all registers associated with the asset and each company can access the relevant information in a copy of such register, knowing the necessary key (Melnychenko, Hartinher, 2016).

According to a global survey conducted by Deloitte, an international auditing firm, 53% of executives in large companies from around the world said that in 2019, blockchain technology would be “crucial” for their

organization. In the previous year, the same answer was given by 43% of respondents (Deloitte, 2019). Among the benefits of the technology, respondents noted, in particular, that blockchain is “democratizing” access to information and contributing to increased trust within organizations.

#### **4. Smart contracts: a basis for the development of decentralized autonomous organizations (DAO)**

Another innovation that significantly affects the quality of interaction between people in organizations are blockchain-based programs that are self-executing and do not require human involvement (or considerably reduce such participation) – the so-called smart contracts.

In general, a smart contract is not “smart” in the literal interpretation of its name. Rather, it is an algorithm, a program written in one of the programming languages (for example, in the object-oriented programming language named Solidity, specially developed for the Ethereum platform), which makes the process of fixing calculations automated and independent of the parties after the smart contract was uploaded to the system. Thus, the technology solves the problem of lack of trust between the parties to the contract when a person – an independent arbitrator – becomes unnecessary (Yakunin, 2018).

The scope of smart contracts is constantly expanding to cover a wide variety of areas. For example, the US government is considering implementing a blockchain-based system that supports smart contracts and can improve government contract management (Higgins, 2017). Smart contracts have been recognized at the state level in Belarus and are used in municipal institutions (e.g. Hamburg, Germany) and many private companies.

Distributed ledger technology and smart contracts are at the heart of the so-called *decentralized autonomous organizations* (DAOs). Their emergence is interpreted by some researchers as the result of (to some extent, idealized) crypto-technological revolution (Mougayar, 2015).

DAOs are based on a set of rules and algorithms by which business transactions are executed. The content and terms of transactions are set using smart contracts and their execution is automatic. Information about each completed transaction is entered in a decentralized registry, which facilitates the interaction of participants and provides high information reliability of the system.

From a technical point of view, DAO is a computer program that runs a distributed chain of independent users and establishes a single set of corporate rules of conduct. The DAO program code presupposes a certain decision-making process, just as in traditional legal entities. These virtual organizations can be programmed for fully autonomous operation or manual mode when

users control the assets with varying degrees of intensity (Ivanov, 2017).

### 5. Convergence of DAO and management control systems

The benefits of DAOs are, first and foremost, a significant reduction in internal and external transaction costs, including costs associated with the management and maintenance of management control systems. The various procedures of coordination, confirmation, verification and approval, as well as the adoption of typical (standard) management decisions are unified and automated. Accordingly, the time and overall effort of managers to perform routine actions related to monitoring and controlling the actions of their subordinates is reduced. Some processes, such as the payment of remuneration, can be completely autonomous with the help of DAOs: smart contracts simply state the conditions that must be fulfilled by employees to receive the appropriate amounts, and then, if they are fulfilled, payroll calculations are automatically run.

The application of DAOs is quite possible in many traditional companies, where it enables to transform the vertical management structures of any division. For example, implementing DAO in the finance department can help to avoid budget fraud and resolve controversial payroll situations. In addition, the DAO “breaks” the usual patterns of interaction between people in the organization and displaces unproductive management approaches.

If, in a traditional management system, company executives directly determine the actions of subordinates (for example, the subordinates may be forced to attend unproductive meetings or gatherings on a regular basis), in a decentralized structure, the decisive factor is whether or not a given action can create value (achieve success at work). If performing a particular procedure makes no sense to the DAO members’ opinion, they do not vote for it and, accordingly, do not do so, devoting their time to issues that they consider more relevant. Thus, the command methods of leadership in DAO do not work – in this case, more important issues are the principles of operation and internal policies, which are agreed and consented by the participants of the decentralized organization.

Accordingly, management control in terms of DAO use takes on forms other than in traditional administrative structures. If the latter give the key role to the manager, who must determine the rules and conditions of the team, in decentralized autonomous organizations decisions are taken collectively. This minimizes such phenomena as subjectivism and personal sympathy on the part of traditional company executives towards individual employees. On the other hand, the absence of a formal hierarchy in DAO opens a direct path for

innovation and employee initiative, an important factor for business development in terms of the technological revolution.

At the same time, management control in the conditions of implementation of DAO can face some difficulties. This is due to the nature of the distributed registries, ledgers and the blockchain in particular, which contain transaction records made by DAO members. The trust model implemented in blockchain technology involves performing sophisticated mathematical calculations to add to the chain the next block with the next batch of transaction records. Such calculations require special equipment which helps the network members to try to calculate the correct number to open the next block of transactions and receive rewards. However, the security of records in a global or public blockchain is guaranteed, first and foremost, by a large number of network members (“miners”) who work in a decentralized manner, and therefore it is highly unlikely for some of them to obtain control of most of the network resources.

But in a particular company, bank, or government organization, it is more appropriate to use a private, non-public, blockchain record that can be viewed by any external user. The difference is that the creation of blocks in a private blockchain is centralized and carried out according to the rules defined by the company itself. Only trusted internal users have access to private blockchain records. However, individual outsiders (such as auditors) may also, as an exception, be entitled to view information or use separate applications.

Private blockchain is almost completely controlled by the company, which causes both opportunities and threats. On the one hand, a company can develop and update blockchain functionality more quickly, and on the other hand, it may face the challenge of ensuring the necessary level of security and trust between different groups of participants. To avoid problems, a private blockchain should have well-designed protocols that allow managers and network owners to effectively control all its members (add and remove members, increase or decrease their rights and authority, define consensus-based decision-making rules, etc.). At the same time, network owners should bear in mind that excessive control can negate the benefits of blockchain that are associated with its autonomy, decentralization and security.

### 6. Conclusions

The technological component of modern management control systems is becoming increasingly important to ensure the expected level of performance of such systems. The interaction of managers and employees is increasingly conditioned by the use of new technologies such as blockchain, smart contracts, the Internet of Things, and artificial intelligence. In this regard, when considering management control systems,

it is worth remembering the effects of emergence, that is, the manifestation of completely new qualities (decentralization, , autonomization, etc.).

It is also important to overcome the lack of trust in the relationships between the participants in the management processes in companies. Without overestimating the role of modern technologies, we note that they are one of the main drivers of high personal and team performance today. The tools of human interaction in organizations, such as smart contracts and decentralized autonomous organizations, bring management control to a new level of development, when the main role is played not by administrative procedures but by reaching consensus and providing a high level of trust between employees and management.

A promising area for the development of decentralization of management control is the area of finance. Many projects are now being implemented

in the field of decentralized finance (DeFi), which is a decentralized, public and unreliable ecosystem that combines various financial services based on public blockchains, mainly Ethereum. DeFi does not have centralized management structures: the rules for conducting business operations are written in a smart contract. Once the smart contract is running, the DeFi application can run autonomously with minimal or zero human intervention.

The openness of the source code of DeFi applications for external audit, which allows users to study the features of the contract or identify errors, is of great interest. Audits can be performed by both independent professionals and users directly. This allows you to build an eco-system of management control on completely different principles, providing for the broad involvement of all members of the organization in the implementation of control and risk management.

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