

## Blockchain Impact on Public Administration Processes in the Digital Economy

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### Abstract

*The purpose of this study is to determine the blockchain impact on public administration processes in the digital economy.*

*The study presents approaches to the transformation of the public (state) governance mechanisms using blockchain. Blockchain systems are classified according to four types: “inclusive-public”, “inclusive-closed”, “exclusive-public”, and “exclusive-closed”. For the information and communication (digital) systems of public authorities, the priority is the exclusive-public or exclusive-closed blockchain. The priority areas of their application in the field of public administration and the main risks of using blockchain systems by public authorities are identified.*

*In the conclusion, the authors determine that the blockchain introduction into the field of public administration will help to increase trust in public authorities, provide high-quality public services, reduce the level of corruption and bureaucracy, protect data from damage or theft, and reduce the risks of data forgery.*

**Key-words:** Public Administration, State (Municipal) Services, Electoral Process, Registration of Property Rights, Land Registry.

### 1. Introduction

Over the past years, the world has been experiencing an abrupt development of the digitalization of society based on the introduction of technologies to optimize management processes, which are becoming a powerful mechanism for the functioning of the digital management

environment (DUDIN et al., 2019). One of the main tools for implementing ubiquitous digital management is blockchain, the introduction of which today has certain positive consequences and in the future will determine the basic technological resource for the development of the entire public administration industry (LYASNIKOV et al., 2020; NOVIKOV et al., 2020).

The relevance of the study is due to the institutional problems faced by society in the development of the digital economy – the problem of trust, high costs of maintaining state registers containing large amounts of information, risks of cyber-attacks, and the likelihood of damage or loss of information due to fraud, theft, or unauthorized use of these registers (MILOVANOVA et al., 2020).

Blockchain allows solving these problems, minimizing costs on the part of participants in electronic interaction, and opening up new opportunities in the creation and management of electronic registers and their promotion in the digital economy. In 2017, the World Economic Forum (WEF) (2020) recognized blockchain as one of the most promising technologies. According to the American analytical company Transparency Market Research (n.d.), in 2024, the global blockchain market will reach \$20 billion with an annual growth of about 59%.

Blockchain is used mainly in the banking, financial, and insurance sectors. However, its potential impact and use in public administration have not yet been fully explored. Therefore, in this study, we consider the use of ICT in the field of public law on the example of blockchain. To make appropriate state and management decisions on the blockchain implementation, it is necessary to analyze the principles and foundations of the functioning of blockchain systems in the field of public administration at the proper scientific level, as well as assess and predict the risks regarding their further implementation.

## **2. Literature Review**

British researcher M. Swan in the book (SWAN, 2015), considering the modern and potential technological aspects of the blockchain, identifies the stages of the blockchain evolution. Blockchain 1.0 is a currency (cryptocurrency) that is used to make digital transfers and payments. Blockchain 2.0 provides for the ability to operate with various types of financial transactions, including operations with securities, stocks, and shares of companies, crowdfunding instruments, debt obligations, pension funds, and derivative financial instruments (forwards, futures, options, and swaps). Blockchain 3.0 extends to government, healthcare, science, education, culture, and art.

In the scientific literature, there are various approaches to the transformation of the public (state) governance mechanisms using blockchain (Table 1).

Table 1 - Approaches to the Transformation of the Public (State) Governance Mechanisms using Blockchain

Source	Concept
SCHWABE, 2019	Blockchain transforms the resource mechanisms of public administration, making them highly productive, perfect, and efficient, and also creates new opportunities for digital transformations of power-public relations, allowing state authorities and local governments to become more public
BECK; MÜLLER-BLOCH; KING, 2018	Blockchain use for state registers is primarily due to a general distrust of the activities of state bodies, which must maintain such registers, protect the rights of owners and keep information unchanged
DE MOURA; BRAUNER; JANISSEK-MUNIZ, 2020	Blockchain will help restore confidence in all public authorities, and most importantly, ensure an appropriate level of public services provided by executive authorities, local governments, and established institutions and organizations that are supported by the funds of the respective budgets
ALEXOPOULOS et al., 2019	The advantages of blockchain in public administration include: durability – it can be stored for an indefinitely long period and protects data from hacker attacks and theft; faster transaction – transactions are carried out much faster and processed 24/7; trust – it allows to carry out exchange operations without intermediaries, which reduces the risks of influence from third parties; reducing the level of corruption – due to the transparency of the transaction, blockchain almost excludes the possibility of using corruption schemes; reduction of bureaucracy in public services

Today, there are two models of blockchain typology: by subjects of administration (inclusive and exclusive) and the mode of access to data, operations, and transactions (public and private) (HAWLITSCHKEK; NOTHEISEN; TEUBNER, 2018), namely:

- Inclusive Blockchain (Permissive Blockchain) – processing (in particular, creating blocks) of transactions is carried out by any users (there are no restrictions on the personalities of transaction handlers).

- Exclusive Blockchain (Permissive Blockchain, Corporate Blockchain) – transactions are processed by certain (separately defined) user entities.
- Public Blockchain – reading data and conducting transactions (sending data to form blocks of blockchain systems) is not limited.
- Closed Blockchain (Private Blockchain) – access to both data and transactions is limited to a certain list of organizations.

The hypothesis of the study: the blockchain introduction in public administration, on the one hand, will help increase trust in public authorities, provide high-quality public services, reduce corruption and bureaucracy, protect data from damage or theft, and reduce the risk of data falsification. On the other hand, the technology is new and not yet very well-known; therefore, for its full-fledged introduction, significant steps are required, in the form of reforms, in particular, in the legislative framework.

The objectives of the study:

- To clarify the classification of the organization of blockchain systems and determine the priority types for digital systems of public authorities;
- To define priority areas of blockchain application in the field of public administration
- To establish the main risks of using blockchain systems by public authorities.

The study consists of an introduction, literature review, methods, results, discussion, and conclusion.

### 3. Methods

The source base of the study was the research of scientists on the possibilities and prospects of using blockchain in public administration processes.

To form the source base, when searching on the Internet, the keywords were used: “blockchain”, “public administration”, “government”, “public services”, and “municipal services”.

Analysis of the source base was carried out using the methods of theoretical generalization, comparative analysis, analysis, and synthesis. It allowed clarifying the classification of the organization of blockchain systems, determining the priority types of blockchain for digital systems of public authorities, identifying priority areas of blockchain application in modern conditions of digitalization of public administration, and establishing the main risks of using blockchain systems by public authorities.

#### 4. Results

Based on the data presented in the study (HAWLITSCHKE; NOTHEISEN; TEUBNER, 2018), we propose to improve the classification of their organization according to four types (Table 2).

Table 2 - Classification of Blockchain Types

No.	Blockchain type	Characteristics
1	Inclusive-public (open)	Blockchain system that operates according to the principles of a conditional “social contract”, when everyone has the right to create a node and take part in the consensus of all participants (the level of trust is low, although the contents of all transactions are open)
2	Inclusive-closed (private)	Blockchain system that functions by confirming the permissions of closed transactions without reliable confirmation of the identities of the participants in the consensus (interaction). The disadvantage of such a system is a low level of trust in transactions since there is no control over the content of transactions and responsibility for entering and confirming false data. This structure is inherent in completely anonymous blockchain systems that are not controlled by government agencies
3	Exclusive-public (open)	Blockchain system that functions as an open data ledger with specific transaction confirmation methods and established participant permissions. Such a system has a high level of trust and control of transactions and can be used in the field of public administration and local government. This is any transactions that take place in a controlled system mode (for example, the acquisition of property rights, issuance of permits, etc.)
4	Exclusive-closed (private)	Blockchain system that operates based on the interaction of “validators” (subjects or services for checking compliance) that have a certain license/permission to confirm closed transactions. Such blockchain systems are used in the banking sector when making digital payments and the like

We believe that for state digital systems, the priority is the exclusive-public or exclusive-closed blockchain since such types provide for the processing of transactions within one organization with a certain number of nodes (computers, servers, etc.) and confirmation of the authenticity of each participant in the transaction (if digital keys are available). As a result, the level of control over the digital system is increased and the transparency and flexibility of the management structure are ensured, which reduces the number of errors and protects it from the risks of the influence of the “human factor”.

Analyzing the studies on the experience of different countries on the blockchain use in the creation of digital platforms (systems) in various spheres of public administration, the following priority areas can be noted (Table 3).

Table 3 - Directions for Blockchain use in Various Spheres of Public Administration

No.	Sphere of management	Source
1	state (municipal) services with identification of users	WANG et al., 2017; ATZORI, 2018
2	electoral process	WANG et al., 2017; AYED, 2017
3	registration of property rights	THEMISTOCLEOUS, 2018; GRAGLIA, MELLON, 2018
4	state procurements	LEMIEUX, 2016
5	state document circulation	LEMIEUX, 2016
6	accounting registers	LEMIEUX, 2016
7	registration of passing qualification tests	ZACHARIADIS; HILEMAN; SCOTT, 2019
8	verification of industrial goods/food	ZACHARIADIS; HILEMAN; SCOTT, 2019

## 5. Discussion

Let us consider in more detail some examples of foreign experience in blockchain use in various spheres of public administration.

*State (municipal) services.* Since December 1, 2015, a program for providing notary services to Estonian online residents on the BitNation Public Notary blockchain platform has been operating in Estonia. The project is carried out with the support of the state program “E-Residency” of the

residence. Already in 2017, the management of the e-Residency program of Estonia proposed holding the world's first state ICO, which allows those who have online resident status to invest in bitcoins (ATZORI, 2018).

*Ensuring the electoral process.* In 2018, the first blockchain-powered municipal elections were held in West Virginia, USA. One could vote from anywhere without ballots and didn't have to go to the embassy or polling station to cast one's vote for the chosen candidate (AYED, 2017).

*Registration of property rights.* One of the most common uses for blockchain is in the maintenance of land registries. For example, the Swedish government has been testing a blockchain-based system for registering and recording land rights since 2016. The Swedish Cadastral Authority (Lantmateriet) has teamed up with blockchain startup ChromaWay, consulting firm Kairos Future and telecommunications company Telia to launch the Chroma Way blockchain platform to digitize real estate ownership records. Work on the introduction of systems for registration of land and property rights based on blockchain is underway in Japan, Rwanda, Andhra Pradesh in India, and Bermuda (THEMISTOCLEOUS, 2018).

Government authorities are introducing this technology to improve the processes of registration of property rights, reduce the time for concluding and registering transactions in relation to the ownership of land plots, and the impossibility of committing fraudulent actions and errors during the registration procedure for the relevant rights.

Since 2017, the blockchain system for registering property rights to real estate has been operating in the UAE. The UAE government has announced that the country should become a world leader in blockchain adoption by 2021. Moreover, the state intends to finance courses and seminars on blockchain introduction into public authorities (GRAGLIA, MELLON, 2018).

Researchers (LEMIEUX, 2017) note that at the initial stage of using blockchain in the field of registering land contracts, there is a likelihood of problems with the primary identification of landowners since the information itself entered into the blockchain registries is not reliable. The blockchain guarantees the immutability of the data and not their accuracy since this system can only be used to verify or provide statements about whether it is fake. However, the validity of the data contained in such an extract cannot be verified.

Summing up the international experience, it should be noted that the geography of blockchain implementation is very different. Blockchain is used both by highly developed countries (the USA, the Netherlands, Sweden), which is associated with the high development of scientific and technological progress in these countries and by countries with a low level of development.

Therefore, we can state the fact that blockchain use is a popular and new phenomenon, a new generation innovation.

At the same time, researchers (KRAFT, 2016) argue that blockchain use as a basic technology of digital management in terms of the functioning of state registers is possible only if the following risks are neutralized (Table 4).

Table 4 - The Risks of using Blockchain in Public Administration and the Conditions for their Neutralization

No.	Blockchain risks	Neutralization conditions
1	Validity of data entry	An effective organizational and legal mechanism for reliable data entry is required
2	Reliability of the access control	The blockchain system must contain a mechanism for reliable management of access rights both to the system as a whole and to individual records
3	Consumer identification	It is necessary to create a reliable system of user identification based on biometric parameters
4	Database synchronization	It is necessary to introduce synchronization of the functioning of all registries, which is achieved through a “consensus” mechanism, which guarantees the complete identity of the databases of all confirming nodes
5	Reliability of interfaces	It is necessary to prevent not only illegal modification of database records but also to eliminate the possibility of distortion of the user interface (for example, tampering with the touch screen interface by replacing frames). To do this, you need to use the interface “validation” mechanism
6	Control over system administrators	Administration of blockchain systems servers is carried out by system administrators who are at risk of “human factor”. Therefore, the function of performing external control over the integrity of the state register must be assigned to different network users. In this case, when the administrator tries to change the data located on the server, it will be impossible to falsify the dissemination of information to all network nodes in the process of changing the checksum of the chain of operations, due to which the integrity of the registry is formed. However, to exclude the possibility of forging the server’s response to erroneous requests and information distortion, this response must be protected by the server’s digital signature

In addition, when using blockchain as modern technology for distributed data processing in the areas of state regulation and state registration of information, sooner or later it will be necessary to solve several legal issues: issues of state responsibility for the functioning of the system; the issue of incentives for users to keep the system running. The introduction of distributed data processing technologies for the needs of government administration will require a significant update of legislation and the solution of very serious legal problems (AL-JENAIBI, 2015).

In addition to the practices of using blockchain in the field of public relations analyzed above, it is possible to introduce blockchain in various spheres of public relations:

health protection (creation of basic medical registries, for example, medical workers, medicines, institutions; introduction of an electronic medical record of a patient and an electronic prescription; development of integrated medical information systems to automate the main processes of work of healthcare institutions, in particular, a registry, doctors, laboratories, diagnostics, reporting, management, financing) (GORDON, CATALINI, 2018);

ecology and natural resources (introduction of an environmental monitoring system; introduction of an electronic integrated permit in the field of ecology and natural resources; introduction of an electronic water balance system) (ZHILI, GUIMIN, 2019);

social protection (introduction of a unified state register of the social sphere and the integration of existing disparate databases; introduction of electronic sick leave; introduction of automation of data verification during the appointment of targeted assistance, benefits, and other types of social assistance; introduction of electronic labor contracts) (ZWITTER, BOISSE-DESPIAUX, 2018).

Summing up, blockchain use will allow transforming the system of public services into a new, high-quality system that will help provide services much faster and better. It will significantly reduce operating costs and, most importantly, ensure the transparency of all operations.

However, governments can face several challenges when using blockchain. Firstly, it is the novelty of the technology; for most ordinary citizens, blockchain is a new and unknown phenomenon. Therefore, it is necessary to familiarize the public with this technology, highlight the advantages and principles of its operation, teach specialists to work with the specified technology, and provide the necessary conditions for work. Secondly, it is the development of a regulatory framework for the use of blockchain at the state level. Thirdly, it is the high cost of this technology, and the government will have to allocate a significant amount of funds for the implementation of the blockchain. Fourthly, the blockchain introduction will lead to a reduction in jobs, in particular, the number of administrators (those who provide services) will decrease. As a result, specialists will have to look for another job or retrain

## **6. Conclusion**

The following conclusions can be drawn.

As a result of the study, the blockchain systems were classified according to four types: “inclusive-public”, “inclusive-closed”, “exclusive-public”, “exclusive-closed”. For the information and communication (digital) systems of public authorities, the priority is the exclusive-public or exclusive-closed blockchain. The priority areas of their application in the field of public administration and the main risks of using blockchain systems by public authorities were identified.

The results of the study confirmed the hypothesis that introducing blockchain into public administration, on the one hand, will help increase trust in public authorities, provide high-quality public services, reduce corruption and bureaucracy, protect data from damage or theft, and reduce the risks of data forgery. On the other hand, the technology is new and not yet very well-known; therefore, for its full-fledged introduction, significant steps are required, in the form of reforms, in particular, in the legislative framework.

The implementation of blockchain systems by public authorities is impossible without reengineering the process of making managerial decisions, active development of digitalization of both public administration and society as a whole.

Further scientific research should be aimed at studying the mechanisms of blockchain introduction into public administration and local self-government to accelerate the transition to a new evolutionary level of social-power relations – the widespread use of digital governance.

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