

How to cite this paper:

Movanu, L. (2023). Blockchain for an efficient public administration. *Perspective Politice*. Special Issue. 133-141[13].

<https://doi.org/10.25019/perspol/23.16.0.13>

Received: April 2023

Accepted: May 2023

Published: June 2023

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Article

Blockchain for an efficient public administration

Abstract: *The beginning of the 21st century shows us an increase in the complexity of all systems. Some states have already implemented national strategies for artificial intelligence and the action plan for high technologies to solve problems of different natures. The challenge of the century is to find new solutions permanently that contribute to the adaptation and development of organizations. In the last decade, blockchain has won the interest of several governments around the world for implementing this new technology in the public sector. In this paper we want to analyze how this tool has been applied in various states and how it can contribute to solving data management problems. Our purpose is to show the importance of using blockchain for interoperability in public organizations in Romania. The use of blockchain involves a new reform of the public administration and the adoption of new regulations.*

Keywords: *Blockchain technology; public administration reform; sustainability*

1. Introductory elements of Blockchain technology

The 21st century is characterized by complexity due to the emerging behaviour of systems through the interactions between their component parts. The fourth industrial revolution is a digital revolution that brings to light tools with different innovative potentials to exploit collaboration between systems by integrating relevant data (Advancing science as a global public good 2019). Thus, this revolution involves various attempts to use new technologies in a wide range of fields, such as the Internet of Things (IoT), Artificial Intelligence (AI), Big Data and Blockchain technology (Myeong and Jung 2019) and which presents significant challenges in their implementation.

Blockchain shows a technology that can help with data exchange in a variety of sectors and it offers the possibility to re-design some economic models (International Finance Corporation World Bank Group, 2019). It acts as

a public record in digital currency transactions such as Bitcoin (Nakamoto, 2018; Terzi et al., 2019). Some authors claim that the two

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concepts present not only the emergence of new technologies, but also the engines of various sociological changes.

Blockchain technology (Myeong and Jung, 2019) is known as a digital “registry” system that acts as a distributed, open, shared, and secure cryptographic registration network that is not stored by a central authority, as it continues to be traditionally approached. All transactions will be permanently visible to all nodes in the system because they have identical “registers” of transactions that are quickly updated each time a new set of transactions is added. Blockchain implementation is mainly based on Open Source software (Allessie et al., 2019).

Literally, Blockchain is seen as a chain of blocks in which specific transactions are stored that cryptography and complex mathematical constructions provide (Berryhill et al. 2018). Due to its linear, chain-like architecture, blocks are fundamentally dependent on each other, so changing the information of one eventually changes the connection it has with all the other blocks in the chain in a way that can be immediately recognized by the others nodes as modified.

The World Economic Forum has identified three layers of Blockchain technology: platforms, applications and general ecosystem.

In the architecture of this technology are identified some main features (Mark et al., 2018; Salnikova et al., 2019): the platform is widely distributed; the registration in the register can be found in the form of a simple text, completely encrypted or divided into separate elements; the records are immutable; the mechanism used to transmit a record involved a certain form of consensus and, in a sense, can be considered “democratic”.

According Blockgeeks website, Blockchain technology is based on three pillars: decentralization, transparency and immutability (Blockgeeks, n.d.). There are fifteen potential benefits of Blockchain development that offer the opportunity to create value and develop new applications as: smart contracts, sharing economy, crowd funding, governance, supply chain auditing, file storage, prediction markets, intellectual property, internet of things, microgrids, identity management, AML and KYC, private data management, land title registry and stock trading (What is Blockchain good for?).

2. Blockchain technology in the public sector

This new technology has potential to contribute to the identification of development directions of society, and to achieve a basic understanding of it (Pilkington, 2016), researchers are conducting studies on how to apply it in different processes (Gabison, 2017; Novak, 2019). Blockchain technology is gaining attention among the various technologies developed due to improving transparency, security and in the distribution of existing centralized information storage (Lee, 2018). The most important aspect in this paper is the potential application of Blockchain technology in the public sector which lead to the construction of more efficient and equitable systems in welfare management and service delivery. Given the sustainability of public administration, its future goes beyond the simple process of providing public services, through the need to use tools such as Blockchain technology and other new technologies that will be developed later. The use of new technologies will help to overcome the limitations of current administrative services and will contribute to the provision of sustainable public services to people (Myeong and Jung, 2019). Although Blockchain technology is seen as a simple development of economic growth, many attempts have been made to improve the efficiency of existing services and maximize the cost-cutting effects by applying this technology.

Growing interest for the new tool – Blockchain technology has led to many attempts to apply it to the public sector in countries around the world. Its introduction in e-government will mean a series of trials, successes but also failures, as well as learning. Regarding the process of developing e-government, Blockchain technology will be able to be used in the exploration of many areas, in the exercise of the right to vote by electronic voting to encourage the participation of as many citizens as possible, in increasing the level of security and transparency of taxation, in improving efficiency in the provision of public services in general.

Blockchain technologies have the potential to enable new voting methods by transforming what often remains a paper-based process into a country or an electronic process with limited validation and audibility capabilities (Berryhill et al., 2018). Through the Blockchain electronic voting system, the content and results of the voting process will be immediately encrypted and then transmitted to the polling headquarters. Blockchains could be used to establish digital identities for citizens, residents, companies and government agencies. In addition, this technology can be used to manage identity, birth certificates, marriage certificates, passport information, visas and death records, other personal records such as health, insurance, financial and banking services. Medical records, for example, could be accessible and interoperable to hospitals in a network or country. Of course, blockchain would not instantly make medical records accessible and interoperable to all hospitals in a network or country, it's a matter of time. The land title register has a natural fit for Blockchain technology because land titles and other property-related records could be recorded chronologically on a Blockchain register, along with any details relevant to the sale of a property that could contribute to a complete historical record of a property.

Adopting this technology through administrative reform can help increase transparency in public administration and reduce the level of corruption in personnel management, recruitment and procurement in public sector organizations. The technology is in its early stages of development and must overcome technical and regulatory challenges and risks before it can be widely implemented (International Finance Corporation World Bank Group, 2019). Next, there are ambiguities about scalability, interoperability, security, transition costs, data confidentiality, and blockchain governance. In such a context of uncertainty, policy makers will have to think a lot about when and under what conditions to use Blockchain technology.

3. E-government and institutional interoperability

3.1. Changing e-government and the future of public administration

Blockchain is expected to change the direction of public administration, to strengthen the community by implementing direct democracy. Thus, the development of public administration can be largely focused on three key elements: economic, security and decentralization.

Blockchain technology will be further developed through application in document management, in the management of advanced information or confidentiality, storage and management of documents, protection of personal information. This technology can help governments reduce fraud, errors, the costs of certain processes and transactions, reduce the time spent on these activities, and through design can provide transparency on the data and transactions performed (Berryhill et al., 2018).

Blockchain technology has also been applied in the field of administration to explore the evolution of future administrative processes. The future administration is more than a mechan-

ical e-government working to improve productivity and transparency based on past computing systems, it is a platform that executes optimal decisions and public policies based on highly intelligent ICT and accurate data collection and analysis.

3.2. Institutional interoperability and data management in Romania

The sustainability of public administration change in Romania requires efficient governance, collaboration and intense interaction between organizations. The challenges identified at the level of institutions are related to interoperability and data management. Various barriers or impediments disrupt the government's efforts to build links to address and manage sustainability issues. These include limitations in the form of structural or vertical fragmentation of authority, lack of access or coordination of key elements such as information / data. There are very few bridges, practices or institutional processes that stimulate the construction and support of the necessary links between institutions. Some of the sustainability issues cross the borders of the institutions, requiring an efficient and integrated response.

For a decade, most institutions have begun to integrate the data they manage into digital databases, which means streamlining business and creating national registers for data access by competent institutions. Gradually, the heads of institutions and their employees are beginning to realize the advantage of interoperability by sharing data or using common platforms for business efficiency and quality public services.

The quality of the interaction between institutions significantly influences the effectiveness or inefficiency of a country's performance (European Commission, n.d.). Traditional hierarchies are gradually being replaced by new forms of organization, which places a new emphasis on the ability to collaborate.

In July 2022, it was published in the Monitorul Oficial of Romania – Law no. 242/2022 on the exchange of data between IT systems and the creation of the National Interoperability Platform (can be studied on the website of the Chamber of Deputies) which appeared as a necessity to regulate the use of new technologies, equipment, software programs and the data used by them, in order to contribute to increasing the degree of interconnection between the IT systems of the authorities and public institutions and to facilitating the exchange of data between them. The objective of this law is to increase the efficiency and effectiveness of the administrative act, by increasing the degree of interconnection of the IT systems of the authorities and public institutions and facilitating data exchange between public institutions. There are several basic registers of the public sector at the national level, according to the activity field. Some institutions use applications such as Excel for their activity.

Blockchain technology can be the next step to be used as a platform for data exchange between institutions and public authorities in order to ensure the interoperability of public IT systems for the provision of Romanian public services. Key areas where blockchain technology can have a major impact: increasing the transparency of public activities, accessibility of services and information, security of sensitive data. Also, this technology can contribute to a better participatory democracy, eHealth system and digital medical prescriptions, electronic authentication and digital signatures, digital cadastre system, digital identity, public procurement system based on blockchain, electronic voting, interoperable and patient-owned medical history, verification of the authenticity of diplomas, certificates, authorizations and others.

3.3. Simplification of inter-institutional and intersectoral processes

Transacting between different institutions, between authorizing officers, can sometimes be difficult because they sometimes use information systems that have limited interoperability. Through smart contracts in Blockchains, some transactions can be automated and the processes between institutions can be more efficient and effective by eliminating the need for third parties and automating the management of transactions.

Organizations that are part of a Blockchain network can share information stored in a common register, which can help ensure that institutions work with the same information, reducing the chances of inconsistencies. Collaborative governance will be a major challenge, which will determine the direction of the Blockchain. By using this new technology, the transition is made from a centralized registry to a distributed one, between the organizations involved. The paradigm shift in public governance is that Blockchain technology can serve as a registry, transaction platform, social assistance and intellectual property rights transfers, inventory system, registration, tracking, monitoring, voting, digital identity, citizen health data, and real estate history information.

3.4. Challenges and limitations of Blockchain technology in the public sector

To understand the potential benefits of blockchains, one must first understand the current issues in data management and transaction security (Berryhill et al., 2018). In this paper, we will discuss current Blockchain initiatives, the various relevant use cases in the public sector, the challenges that Blockchain technology poses to public administration, and its limitations that may make technology inappropriate for certain uses. Data protection, confidentiality of information, coding constraints and governance decisions add to the complexity. These challenges, limitations and considerations need to be understood by leaders and civil servants, as Blockchains continue to expand from the private sphere to the public sector.

Today, Blockchain technology is still unstable and many trials and errors are inevitable. Blockchain technology is under development and future studies will be needed to elucidate its philosophical ramifications on politics, the public sector, the economy, culture and society, as well as the social change that this technology will create. It introduces the possibility of creating completely new ways of managing information, which must be understood and explored by the public sector in order to take advantage of the new opportunities it presents.

In general, Blockchain is a list of transactions and, at most, contains small pockets of data used to execute and guide smart contracts, but it is not designed for general data storage. However, this technology allows large amounts of data to be stored outside the blockchain and connected in a block transaction. However, a hybrid approach will be needed to track both Blockchain technology and a data storage solution, which provides the ability to link Blockchain transactions with data stored outside the chain and stored elsewhere. As with traditional information systems, the quality of the data originally entered will directly affect the quality of the data on a Blockchain and the quality of the results obtained from that data.

The use and implementation of Blockchain technology presents some challenges because it is not a solution to every problem in the public sector (Berryhill et al., 2018). One of the most important features and benefits of technology is immutability, but it is probably also the biggest limitation in terms of practical applicability. A blockchain is essentially a platform to

which information can only be added. Unlike traditional databases used today by the public sector, there is no way to delete data that has been entered into the Blockchain. In cases where updating and / or deleting data is a common situation, using Blockchain technology may not be the best option. Decision makers should decide whether the benefits of using blockchains outweigh the inability to update and delete data, and the question of whether immutability is practical for the type of data they use. Another sensitive issue regarding the use of Blockchain technology concerns transparency, confidentiality and decentralization. Blockchains without permission allow for perfect transparency by revealing everyone's interactions. Confidentiality settings are almost non-existent, but existing rules and laws insist on the absolute protection of personal data information. In addition, the consequences of the European Union General Data Protection Regulation (GDPR) on Blockchain technology are not yet fully understood and the interaction between this new technology and data protection laws such as the GDPR requires careful analysis.

Transparency in Blockchains is a benefit but also a weakness when it could bring risks to the exploitation of personal data, so governments must carefully consider what information is stored on a Blockchain and therefore immutable and what information is stored outside the chain. Public officials will need to consider technical confidentiality as part of the process of designing the development of Blockchain technologies for their organizations. The public sector needs intensive courses in data management, coding, to ensure the efficient and secure management of private data, to make appropriate decisions in the design of Blockchain protocols and applications. Public sector employees must have sufficient understanding of what the blockchain principle is and how it compares to the usual means and methods of data storage and communication.

Blockchains are built and governed by engineers, code developers and other decision makers who are given key roles in developing a Blockchain platform. They have de facto central authority and the codified actions and decisions they take may not be as transparent as the transactions themselves, which raises suspicions as to who or what is the legitimate governing body of Blockchains, be it public or private.

4. Application of Blockchain technology in different states in the public sector

Governments have begun to react in different ways and adapt to the advent of Blockchain technology. There are more than 200 Blockchain technology initiatives in which governments in more than 50 countries around the world have been involved. These initiatives targeted most – public services, continuing with financial services, technology and the Internet of Things, medical services, real estate, land cadastre, supply chains, energy, transportation, education and telecommunications.

This technology has been introduced nationwide as part of a large-scale specialized solution.

Various case studies show how Blockchain technology is currently applied in the public sector and how their own platforms have been created, tailored to the needs of their members. Institutions can benefit greatly from using blockchain technologies in most of the functions and services they provide to their citizens, overcoming existing inefficient administrative procedures by saving time and financial resources while providing satisfactory administrative services (Makridakis and Christodoulou, 2019). The reasons for using Blockchain are to eliminate fraud and speculation and to ensure interoperability and transparency.

4.1. The case of Sweden – the application of Blockchain technology in the Land Registry

Sweden is an example of an innovative state open to new technologies through the multitude of projects it has implemented over time. In this state, an attempt has been made to go beyond the existing digital land registry systems in order to record land transactions and properties – for more efficient, faster and citizen-friendly services. From a more general perspective, the centralized information storage system that was developed in Sweden no longer meets the requirements of greater transparency and accountability (Berryhill et al., 2018). The Land Registry Authority has tried to “explore and investigate whether Blockchain can be an alternative to support the process of a real estate transaction; sale and purchase; finance and mortgages; applications and registrations title / ownership instead of traditional technical database solutions and web applications”.

The experiment allowed digital actors in the Swedish public sector to learn more about new technology for the future of public services. The experiment did not clearly establish the impact on the transaction and land ownership, although Blockchains theoretically responds well to the requirements of a secure and transparent system of information exchange and collection by a government agency. The limitation of the implemented project consisted in the legal non-recognition of digital signatures on smart contracts. Although blockchains as a system can work, they would have no legal value – transactions and contracts signed on a blockchain may not be legally binding which requires regulations on this subject. The functioning of the governance framework remains unclear around the Blockchain.

4.2. The case of Estonia – the use of Blockchain KSI technology

A blockchain platform, known as KSI, has been used in Estonia since 2007 to provide integrated services to citizens in several programs. The country is presented as one of the earliest adopters of government-distributed registry technology. E-Estonia, a government policy that facilitates citizens’ interactions with the state through the use of electronic solutions, tests and implements the Blockchain on public services, such as national health, judicial, legislative, security and trade systems, with expansion plans of its use in other spheres. However, representatives of the Estonian government are thinking about when it makes sense to move from a traditional data infrastructure to this new system because beyond experimentation, they have not yet found enough reasons to justify the use of such technology alone.

5. Conclusions

This study about blockchain technology is a section from the thesis “Sustainable social change. Social processes and administrative instruments” presented in September 2021 at the NUPSPA, Bucharest, Romania (the thesis can be studied at the National Library of Romania). The subject has been updated with current information.

In this paper we don’t try to make use of marketing stuff by tormenting the reader with overly positive judgmental statements along the lines of blockchain, we want to emphasize the opportunities and challenges that this new technology can offer to the public sector in the near future.

There is a reluctance on the use of new technologies by public administration because digital skills are not very well developed at civil servants, in general. Another reason for this re-

luctance is that there is uncertainty about the opportunities and risks of using Blockchain technology, being in an exploration process. At the moment, the costs of using such technology are still high until it is used on a larger scale by organizations. The future envisages a networked public administration based on cooperation and coordination within the public administration, as well as with stakeholders. Blockchain technology has attracted the attention of a large number of organizations but a deeper knowledge of it will determine whether or not it is a sustainable solution for public administrations in the world. Exploring new technologies is a step in developing a new way of organizing and functioning of public administration.

Conflicts of interest

The author declares no conflict of interest.

About the author

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