



New Bulgarian University
Master's Faculty

Department of National and International Security

Teodora Kirilova Licheva

BLOCKCHAIN SECURITY IN GOVERNMENT

A V T O R E F E R A T

ON THE DISSERTATION

for the award of the scientific degree "Doctor"
in the "Security Strategies and Policies" program in the field of higher education
9. Security and defense, professional direction
9.1. National Security

Scientific supervisor: Prof. Nikolay Radulov, Ph.D.

Sofia

2023

The dissertation was discussed and accepted for defense at an extended meeting of the Department of "National and International Security", held on 15.11.2023.

The dissertation consists of 210 pages.

Main text – 199 pages.

Number of literary sources – 86.

Number of publications on the dissertation – 9

The defense of the dissertation will take place at an open meeting of a scientific jury composed of:

- 1.
- 2.

The materials for the defense are available to those interested in building 2, room 203 of New Bulgarian University

I. General characteristics of the dissertation work

1. Volume and structure of work

The dissertation consists of 210 pages. In terms of structure, the work consists of three parts, including introduction, conclusion and references. 305 footnotes have been made. The list of used literature includes 86 sources, of which 10 are in Bulgarian, 1 in Russian, 1 in Chinese and 62 in English.

2. Relevance of the research

The discussed topic is related to issues that are extremely important and topical, due to the increasingly intensive development of new technological opportunities and their inevitable use in state administration. Ensuring information security, as part of national security, is of paramount importance to restore trust in institutions, as well as to improve efficiency and effectiveness of administrative services and record keeping.

The thesis on which the dissertation is built answers the main question in the modern society of rapidly developing and changing information technologies: To what extent can digital information be trusted? The research gives a precise and definite answer to the question. With the introduction of blockchain technology, integrity, credibility and non-manipulation of data are guaranteed. Coordination and cooperation between state institutions and society will lead to an increase in economic and social activity to ensure civil security.

The proposed models and methodologies for the implementation of the blockchain system are applicable to both the administrative structures of the state apparatus and the information systems of the Ministry of Internal Affairs and special intelligence services. This, in turn, makes the research relevant and applicable in the presence of a state policy for the implementation of innovations.

3. Object and subject of the research

The object of the study is information security, which guarantees the reliability, integrity and truthfulness of the data.

The subject of the research is the possibilities for modernizing and modernizing a state administration that is protected, secure and offers quality e-services and effective and efficient use of databases and record keeping.

4. Goals and main tasks of the dissertation

The thesis of the thesis is that with the introduction of the blockchain system, the state administration will be transformed, modernized and modernized, increasing citizens' trust in it, administrative services will be digitized and data collection will be on a "one-time" basis.

5. Research methodology

The thesis explores the possibilities of blockchain implementation, using the best practices of the USA, Western Europe, China and South Korea. The studies are theoretical - of the most technologically developed countries in the world and empirical – as a result of my experience and practice in public administration. Analyzing the problems of information security in our country are presented in the light of the possibilities of rapidly developing technologies, and the focus is on their application in specific administrative services, storage of digital information from archival institutions and the information systems of the Ministry of Internal Affairs and security services.

By analyzing and using the best existing practices, the variants of the new technological possibilities are presented, which allow optimization of the activity of the administration and high efficiency of the state administration.

The deductive method, analysis, comparative analysis are used throughout the development to determine the problems and present appropriate methodologies for implementing the block system in public administration.

The system method makes it possible to examine the possibilities of high technologies, mandatory digitization, hyper-connectivity of data and their impact on information security, as part of a comprehensive system of the country's national security.

6. Contributions

The dissertation is a serious development that offers modern and modern solutions for change in the administration, as a part of the state government of the country.

Although it will likely take time to develop and implement a methodology and procedure for blockchain application in the government sector, there is no doubt that the technology has potential and is applicable in various sectors of government.

A specific contribution of the study is the definition of the concept of management security, through a thorough and meaningful analysis.

7. Practical significance of the study

The proposed practices and implementation methodologies are fully applicable in all state and municipal administrations, as well as the Ministry of Internal Affairs, security services, despite the specifics of their activities, and fully meet the level of security, reliability and authenticity guaranteed by blockchain technologies.

8. Limitations

The limitations imposed on the development are that only blockchain technology is presented, of all high-tech solutions. A restriction is also imposed on the blockchain application. The possibilities in the administrative processes of the state government were examined.

II. Description of the content of the dissertation in accordance with the arrangement and numbering of the chapters in the scientific work

Introduction

The introduction aims to justify the relevance of the topic under consideration, the aims and objectives of the dissertation work and the implemented methodologies for implementation and application.

1. Chapter One. Nature and elements of blockchain security

1.1. Essence of blockchain technology

Blockchain is considered one of the most promising achievements in the development of information and communication technologies. The use of the block system is already applied in various spheres of socio-economic life, and its application creates certain guarantees of increased security.

Blockchain is defined as a system for recording information in a way that makes it impossible to change, manipulate or defraud the system. It is essentially a digital ledger that is copied and distributed across the network of computer systems on the blockchain. The information is stored in the so-called "chain of blocks" each containing a certain number of communications¹. The technology is used to securely transfer values such as money, property, contracts, etc., without requiring a third-party intermediary, for example, a participant such as the banking sector or administration.

¹ Genkin, A., Mikheev, Al. Blockchain: How it works and what awaits you tomorrow, Moscow, 2018, 35

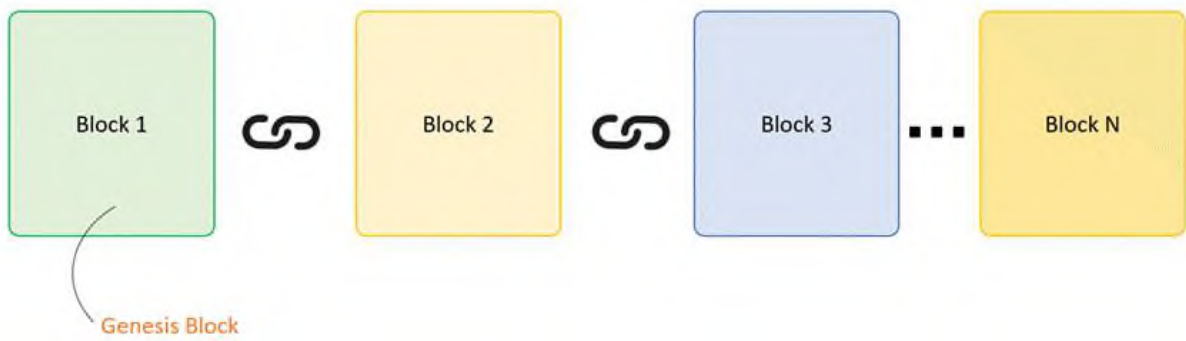


Figure 1. Schematic of a blockchain system²

The blockchain system consists of the following configuration of elements:

1. Data. This is the information that is stored in the block element;
2. Hash³. This binding element is unique, like a fingerprint, and is transmitted in the subsequent block;
3. Hash but on previous data. The hash of a previous block is the last piece in the blockchain chain.

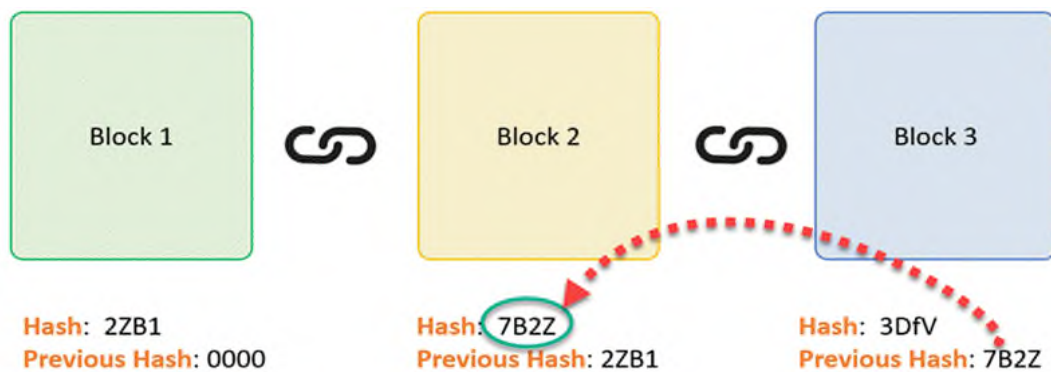


Figure 2. Schematic of a blockchain system with emphasis on a hash element⁴

The transaction is verified by the network through a "consensus mechanism" that allows users on the peer-to-peer (P2P)⁵ network to validate transactions and update the network-wide ledger.

² <https://www.guru99.com/blockchain-tutorial.html#1>

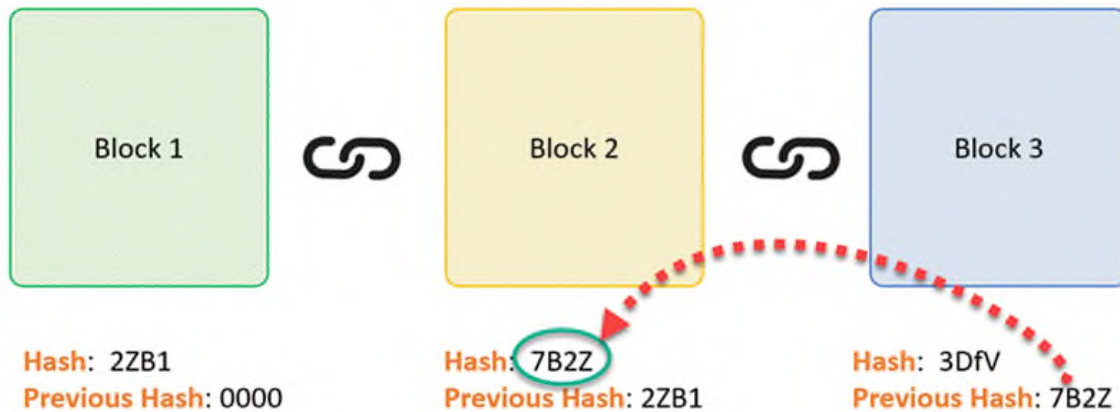
³ Hashing is a cryptographic representation of a set of information. Regardless of the initial size (it can be a file of any format, from 1 byte or 100 terabytes and more), and the output will be a fixed-length string. <https://kriptonovini.com/2020/11/18/what-is-hash/>

⁴ <https://www.guru99.com/blockchain-tutorial.html#1>

⁵ A network (from the English language peer-to-peer) , created when two or more devices (most often computers) are connected and share resources. These are computing or networks with a distributed application architecture that divides tasks or workloads between participants <https://en.wikipedia.org/wiki/Peer-to-peer>

This forms a chain of blocks, hence the name of the new technological possibility blockchain, derived from *block* (in Bulgarian: block) and *chain* (in Bulgarian: chain) ⁶.

Three block chain. The 1st block has no predecessor and it has no hash of the previous block. Block 2 contains the hash of block 1. While block 3 contains the hash of block 2.

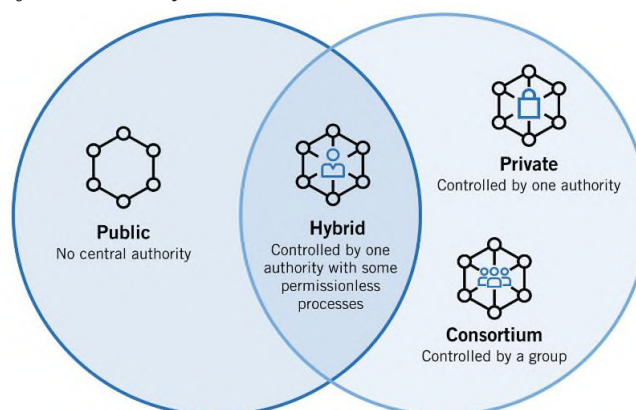


*Figure 3. Schematic of a blockchain chain*⁷

Therefore, all blocks contain hashes of previous blocks. This is precisely the technique that makes blockchain such a secure and reliable technology, guaranteeing the security and protection of data. This security will increase citizens' confidence in the working processes of the administration and reduce the opportunities for abuses and corrupt practices. Government will be reliable, secure and responsive to the modern needs of the public.

Depending on the access to information in the blockchain network, four main types can be distinguished.

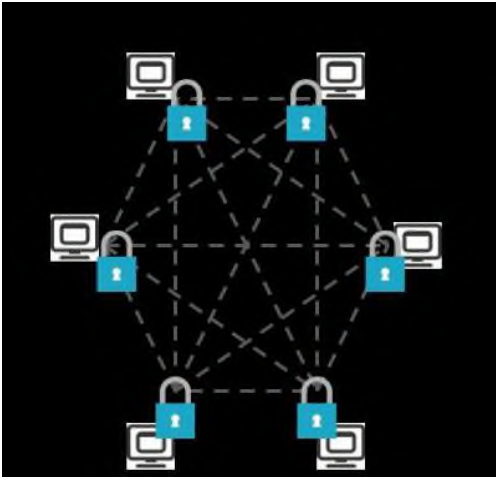
*Figure 4. Types of blockchain systems*⁸



⁶ Allesie , D. , Sobolewski , M. , Vaccari , L. , Blockchain for digital government . 2019, 9

⁷ <https://www.guru99.com/blockchain-tutorial.html#1>

⁸ <https://www.foley.com/en/insights/publications/2021/08/types-of-blockchain-public-private-between>

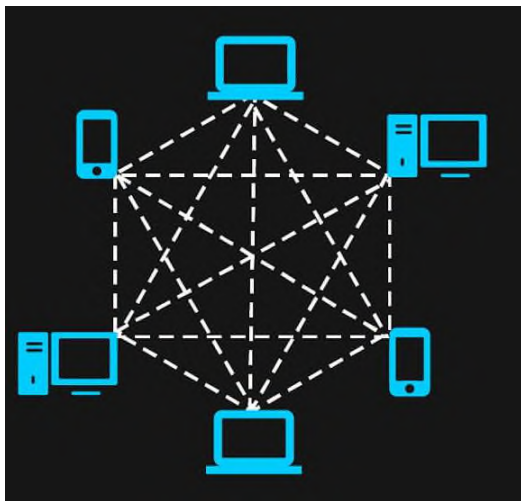


A public blockchain system

In this type of blockchain, ledgers are visible to everyone on the internet. It allows anyone to verify and add a block of transactions to the blockchain. They are open source, which is supported by many administrators⁹.

An example of the application of this type of blockchain system is Bitcoin.

*Figure 5. Schematic of a public blockchain system*¹⁰



Private blockchain system

The private blockchain system is generally used within an administration/organization¹¹. Here the role importance of the different participants in the process is introduced.

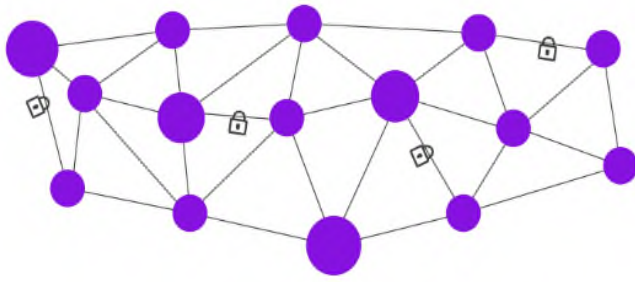
*Figure 6. Schematic of a private blockchain system*¹²

⁹ Nara, BlockchainWhitepaper, 2019, 6

¹⁰ <https://medium.com/coinmonks/a-beginners-guide-to-understanding-the-blockchain-part-4-public-vs-private-blockchains-37ff950ccb47>

¹¹ This is the most suitable blockchain system for application in special services and in the system of the Ministry of Internal Affairs (b.a.)

¹² <https://www.foley.com/en/insights/publications/2021/08/types-of-blockchain-public-private-between>



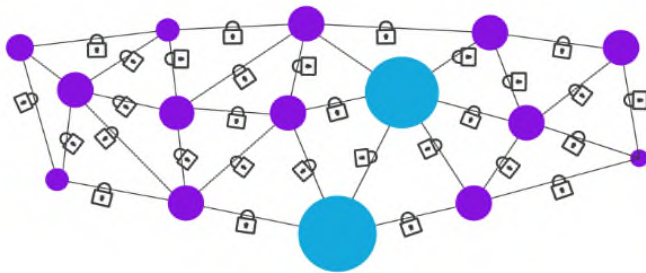
*Permitted a or hybrid
blockchain system*

Sometimes institutions use the best of the two previous models.

An example of this is banking institutions that share sensitive

information about cash reserves through the blockchain system¹³.

Figure 7. Schematic of a permitted/hybrid blockchain system¹⁴



Consortium

In this variant of blockchain, only a group of organizations can

verify and add transactions. Also called federated blockchain.

Figure 8. Schematic of a consortium blockchain system¹⁵

¹³ Nara, BlockchainWhitepaper, 2019, 6

¹⁴ <https://komodoplatform.com/en/academy/blockchain-technology-types/>

¹⁵ <https://komodoplatform.com/en/academy/blockchain-technology-types/>

Table 1. Advantages, disadvantages and uses of the blockchain

	Public	Private	Hybrid	Consortium
Advantages	Independent/ independent; Transparent; Credible.	Access control. Presentation/ performance.	Access control; Presentation/ performance; Magnitude.	Access control; Magnitude; Security.
Disadvantages	Presentation/ performance; Magnitude; Security.	Credibility; Credibility check.	Transparency; Upgrade.	Transparency.
Usage	Cryptocurrency; Validation/ document verification.	Supply chains; Available to the holder.	Medical records; Real Estate.	Banking; Research studies; Supply chains.

The main advantages of the blockchain system are:

1. Reducing costs, time and complexity in the exchange of intergovernmental and public-private information, which improves the administrative functions of government;
2. Reduction of bureaucracy and corruption, due to the use of distributed ledgers and programmed smart contracts;
3. Increased automation, transparency and accountability of information in state registers, for the benefit of citizens;

4. Increased confidence of citizens, individuals and entities, in government processes and record keeping, through algorithms that are not under the control of government alone¹⁶.

Blockchain security is a comprehensive risk management system for the blockchain network, using cybersecurity frameworks, assurance services and best practices to reduce risks against attacks and fraud¹⁷.

Blockchain technology creates a data structure with inherent security qualities. It is based on the principles of cryptography, decentralization and consensus, which guarantee trust in transactions and truthfulness of data. Each new block is linked to all blocks before it in a cryptographic chain in such a way that it is impossible to tamper with. All transactions within blocks are validated and reconciled through a consensus mechanism, thus ensuring that each transaction is true and correct¹⁸.



- Blockchain is not Bitcoin, but it is the technology behind Bitcoin;
- Bitcoin is the digital token and blockchain is the ledger to track who owns the digital tokens;
- There can be a blockchain without Bitcoin, but there can be no Bitcoin without a blockchain.

1.2. Transforming the public and private sectors through blockchain technology

The digital hyper-connectivity that is everywhere in the world around us has not only given rise to the availability of more data, but also led to a significant transformation in the way the economy works and interacts. The public sector is no exception. Citizen-oriented governance – transparent, efficient, cost-effective and providing real-time e-services, thereby building the much-needed trust in institutions.

Uses of the blockchain system in government and the public sector are mainly centered around three of the main areas of the technology:

A. Building trust with citizens;

¹⁶ Allessie , D. , Sobolewski , M. , Vaccari , L. , Blockchain for digital government . 2019, 10

¹⁷ <https://www-ibm-com/topics/blockchain-security? x tr sl=en& x tr tl=bg& x tr hl=bg& x tr pto=sc>

¹⁸ <https://www-ibm-com/topics/blockchain-security? x tr sl=en& x tr tl=bg& x tr hl=bg& x tr pto=sc>

B. Protection of Sensitive Data;

C. Improve efficiency and reduce costs.

Table 2. Application of blockchain technology in various sectors

Sector	Usage
Markets	<ul style="list-style-type: none"> • Billing, monitoring and data transfer; • Quota management in the supply chain network.
State sector	<ul style="list-style-type: none"> • Transnational customized management services; • Electronic voting; • Digitization of documents/contracts and proof of ownership for transfers. • Registry and identification; • Registration and data exchange; • Tax receipts, Notary services and register of documents.
IoT ¹⁹	<ul style="list-style-type: none"> • Agricultural and drone sensor networks; • Smart home networks; • Integrated Smart City; • Smart home sensors; • Self-driving cars; • Custom robots, robotic component; • Custom drones; • Digital assistants.
Healthcare	<ul style="list-style-type: none"> • data management; • Universal data banks for electronic medical records; • Large databases to analyze the flow of health data; • Digital Health Wallet and Smart Property; • Health record; • Contracts for personal development.
Science and art	<ul style="list-style-type: none"> • supercomputers;

	<ul style="list-style-type: none"> • Crowd Analysis; • p2p resources; • Digital services for skill.
Financial Accounting	<ul style="list-style-type: none"> • Payment in digital currency; • Payments and transfers; • Cartesian capital markets using a computer-to-blockchain network; • Clearing and Trading and Derivatives; • Accounting.

The security that blockchain guarantees to citizens is of national importance, as part of national security in the country. In Dubai, the world's first smart city is being created²⁰, in El Salvador a Bitcoin law comes into force²¹, the Monetary Authority of Singapore²² is also based on blockchain and makes payments in different currencies on the same network.

- Smart cities²³;
- Banking;
- State public procurement;
- Digital Identity Management;
- Building better administrative services through blockchain;
- Property registers;
- Verification of certificates;

A few areas where the impact of blockchain technology can dramatically improve security and reduce opportunities for crime are:

- Land registration - eliminating the possibility of fake transactions, theft of properties

²⁰ A SmartDubai Government Office is being established (<https://www.itu.int/net4/wsis/archive/stocktaking/Project/Details?projectId=1514437355>) . The aim is to optimize the future plan of the smart city. The use of blockchain technology is at the heart of this optimization.

²¹ Bitcoin becomes a major payment method, for the first time at the state level. All Bitcoin transfers in the country will be done using the blockchain.

²² The Monetary Authority of Singapore is leading a blockchain-based project that offers multi-currency payments on the same network. Working with Temasek and JP Morgan, MAS (<https://www.jpmorgan.com/news/dbs-jpmorgan-and-temasek-to-establish-platform>) is improving the overall cost efficiency of businesses across the country.

²³ A smart city is a technologically advanced urban area that uses various types of electronic methods and sensors to collect specific data. The information obtained from this data is used to effectively manage assets, resources and services; in return, this data is used to improve operations throughout the city https://en.wikipedia.org/wiki/Smart_city

and manipulation of documents²⁴;

- Identity management – thwarting the possibility of identity theft and creating opportunities and capabilities for verification and identification important for the implementation of procedures for public order and security, guaranteeing the civil rights of the population;

- E-voting - minimizing the possibilities of falsification of elections, processes of buying votes and manipulation of election results;

- Protection of sensitive data - encryption guarantees the truth, integrity and reliability of the data;

- Healthcare - electronic patient records and databases. Transfers of patients and medical services are carried out at the international level. The use of blockchain will stop draining healthcare institutions and patient data will be accessible anywhere in the world at any time.

As the popularity of blockchain grows, many companies are starting to use the blockchain. It is most often used in the following sectors in the private sector:

- Supply Chains;

- Insurance;

- Energy.

1.3. Elements of Blockchain Security

This section of the thesis examines and analyzes the blockchain elements that make the system secure and reliable.

1.3.1. The Merkle tree

A Merkle tree or Hash tree as it is also known is a cryptographic tree in which each "leaf" has a cryptographic hash of a block of data and each node that is not a leaf has a hash of the labels of its child nodes. This allows efficient and secure verification of the structure and content of a large data structure.

Ralph Merkle²⁵ is the author of this concept, which is where its name comes from.

²⁴ Allessie, D., Sobolewski, M., Vaccari, L., Blockchain for digital government, 2019, 18

²⁵ https://en.wikipedia.org/wiki/Ralph_Merkle

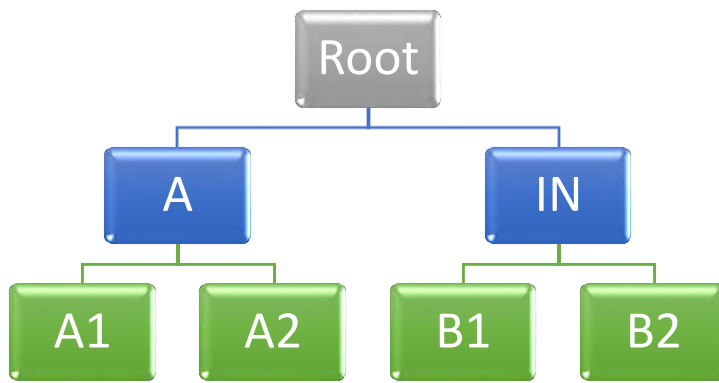


Figure 9. Merkle tree structure

1.3.2. Smart contracts

Another element of security offered by blockchain technology is smart contracts. With them, human intervention is eliminated, eliminating even the smallest opportunities for corruption and manipulation and reducing the time required to perform a certain activity.

Smart contracts (also called smart contracts - from the English SmartContracts) are electronic contracts that are written in blockchain code and are based on the function "if/when...then..."²⁶.



Negotiating Parties

Smart Contract

Usage

Smart contracts are effectively automatic contracts. Such a contract becomes effective upon the occurrence of certain events. Within a smart contract, there are as many stipulations as are necessary to assure the participants that the task will be completed satisfactorily.

There are three steps to creating a smart contract:

- Reaching an agreement;
- Performance of the contract;
- Computer readable code.

²⁶ <https://www.ibm.com/topics/smart-contracts>



Figure 10. Smart contracts with blockchain encryption

Features of smart contracts²⁷

- Transparency²⁸;
- Distribution;
- Normativeness;
- Security;
- Autonomy;
- Immutability;
- Irreversibility;
- Impossibility of Default;
- Personalization;
- Anonymity

Difference between smart contracts and classic contracts²⁹

A classic contract



²⁷

[https://baike.baidu.com/item/%E6%99%BA%E8%83%BD%E5%90%88%E7%BA%A6/19770937#reference-\[1\]-20423455-wrap](https://baike.baidu.com/item/%E6%99%BA%E8%83%BD%E5%90%88%E7%BA%A6/19770937#reference-[1]-20423455-wrap)

²⁸ <https://academy.binance.com/zh/articles/what-are-smart-contracts>

²⁹ <https://rich01.com/what-is-smart-contract/>

Smart contracts



The use of smart contracts not only completely eliminates the intervention of third-party companies, such as middlemen, but also shortens the time of the entire contract.

Advantages of smart contracts compared to classic contracts:

- Security;
- Efficiency;
- Reliability;
- Independence from third parties.

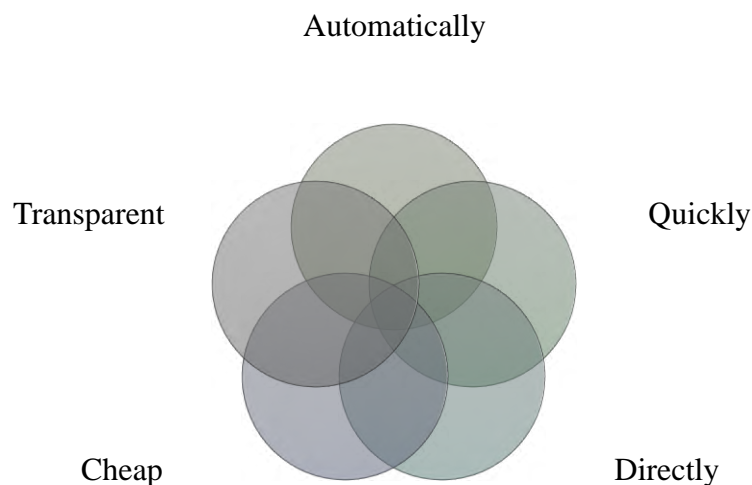


Figure 11. Advantages of blockchain technology

The use cases of smart are many and their application is in different spheres, I will focus on a narrower set of possible use cases.

- Electronic voting³⁰;
- Healthcare³¹;
- Mortgage transactions and real estate;

³⁰ <https://rich01.com/what-is-smart-contract/>

³¹ There again

- Financial services and insurance companies;
- Supply chains;
- Licensing.

1.3.3. System manipulation

An interesting thing about the blockchain system is that it uses a distribution method of protection. Instead of using a central entity to manage the chain, blocks use a distributed peer network and anyone is allowed to join. When someone enters this network, they will get the full copy of the blockchain. Each computer is a so-called node or branch.

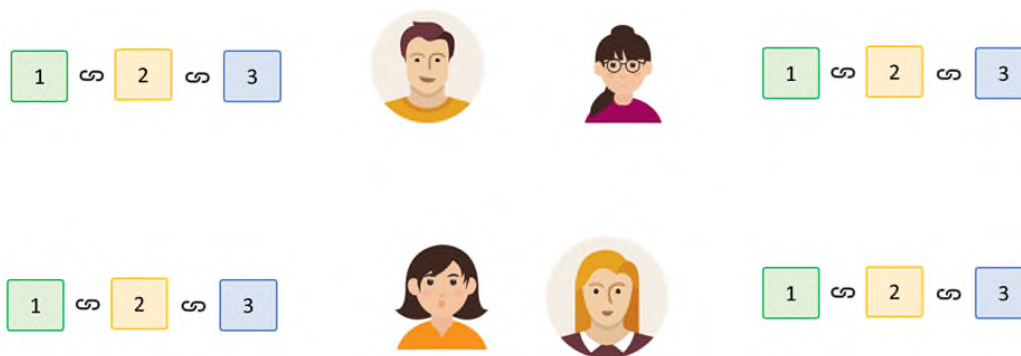


Figure 12. Schematic of a decentralized network

In case any user wants to create a new block, then this new block is sent to all users in the network. After full verification by each node/fork, this block is added to the blockchain.



Figure 13. Scheme of the distribution network responsibility³²

All these nodes in the network must unanimously agree which blocks are valid and which are not. The following conditions are necessary to successfully forge a blockchain:

1. They must tamper with all the blocks of the chain;

³² <https://www.guru99.com/blockchain-tutorial.html>

2. To repeat the proof of work for each block;
3. Take control of more than 50% of the p2p network.

This is why the blockchain system is so reliable and secure. This is also its main advantage for use in the public and government sector. The protection, integrity and credibility of data are the basis of information security, which guarantees the security of the person and civil rights.

2. Chapter two. Blockchain Governance and Security

2.1. Blockchain and governance

This chapter focuses on the opportunities blockchain offers to transform government processes and services. As the administrator processing and storing personal data, by default for society, government institutions are one of the main targets for hackers. The government could reduce and even completely avoid these attacks by implementing a blockchain data system. Such data structures strengthen network security, reduce the risk of a single point of failure, and can make breach attempts unsuccessful and fail. As a result, the security of management is ensured, as part of the national security of the country

Government institutions, such as the Ministry of the Interior and security services, need to seriously emphasize blockchain applications in cyber security. According to the developers, "Blockchain technologies have the potential to revolutionize the way we manage online identity and access to the Internet³³. "

³³ https://www-boozallen-com/s/insight/blog/3-potential-benefits-of-government-blockchain.html?_x_tr_sl=en&_x_tr_tl=bg&_x_tr_hl=bg&_x_tr_pto=sc

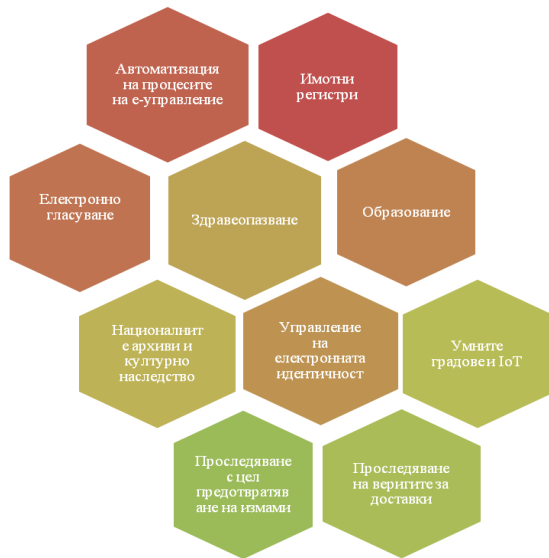
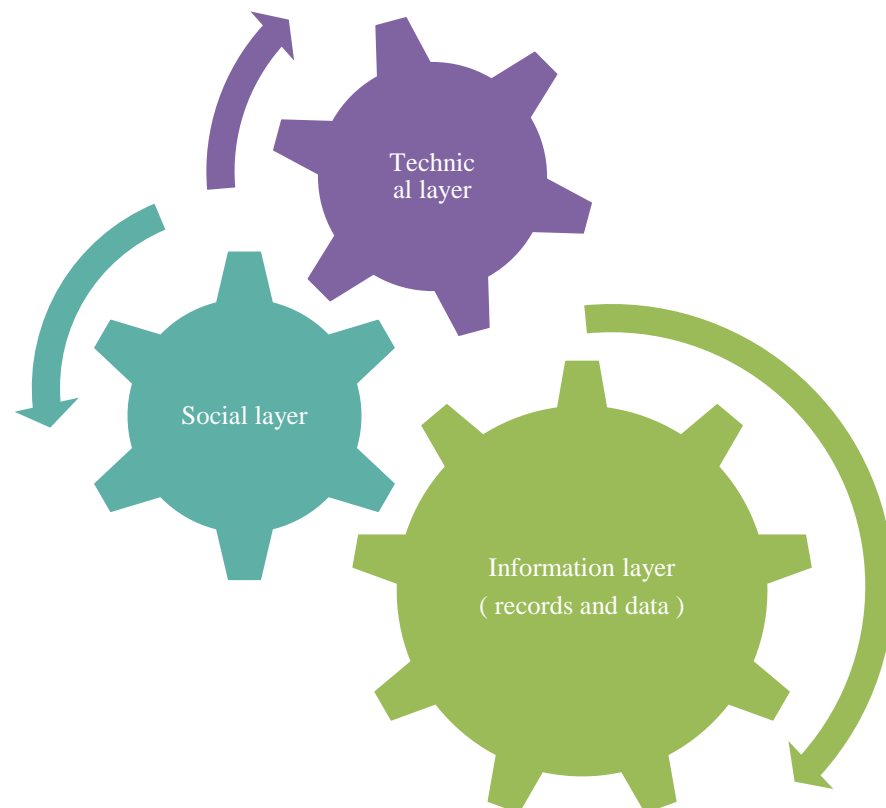


Figure 14. Areas in which the blockchain system is used³⁴

The possibility of implementing a three-layer model for the implementation of blockchain in public administration is analyzed.



³⁴ <https://thedocs.worldbank.org/en/doc/009c961203ebfc131b28feca946c7a3d-0350012021/original/Lemieux-World-Bank-GovTech-Presentation.pdf>

Figure 15. Blockchain implementation framework and DTL solution under the “Three Layers” model (Lemieux and Feng, 2021)³⁵

2.2. Blockchain and the control of personal data

Blockchain technologies allow us to increase trust in institutions, but for this purpose we first need to digitize the relevant processes and then - to include blockchain as an additional layer, adding security and traceability.

In 2018, it created the European Block Space³⁶ (EBP). With a joint declaration of all EU member states and members of the European Economic Area (Norway and Liechtenstein). The signatories of this joint declaration commit to work together to realize the potential of blockchain-based services for the benefit of citizens, society and the economy. As part of this partnership, the European Blockchain Infrastructure for Services is being built³⁷.

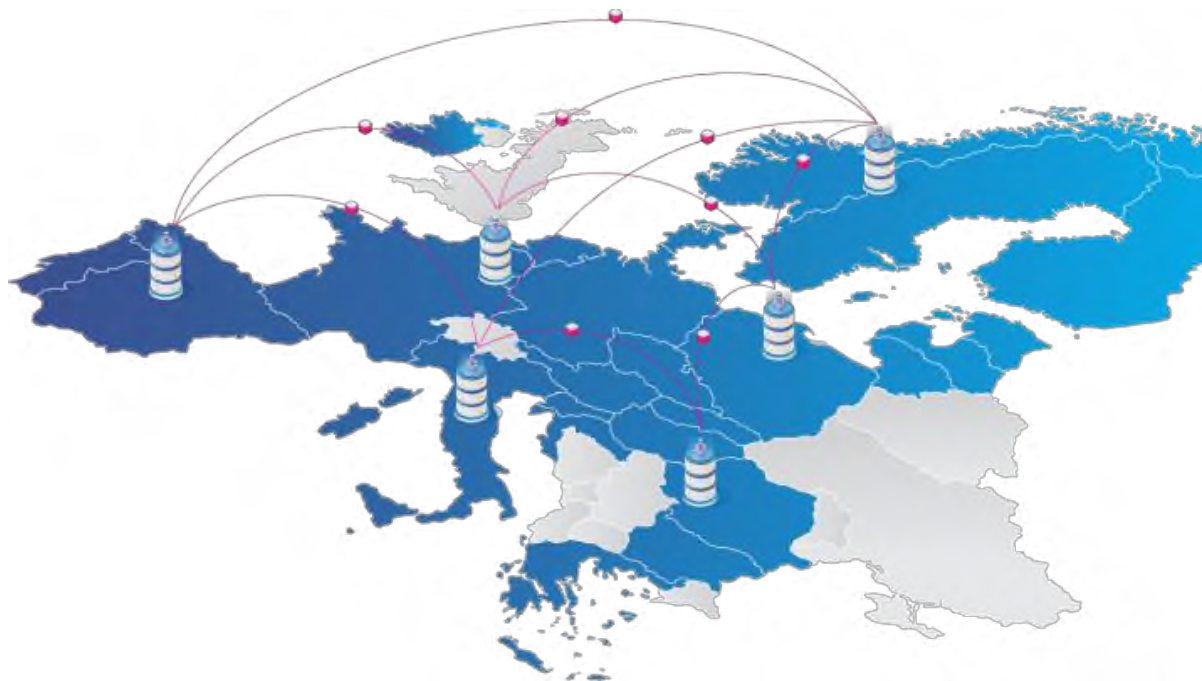


Figure 16. ESBI architecture³⁸

A key role in the deployment is played by EBP – the platform for developing the EU blockchain strategy³⁹.

³⁵ <https://thedocs.worldbank.org/en/doc/009c961203ebfc131b28feca946c7a3d-0350012021/original/Lemieux-World-Bank-GovTech-Presentation.pdf>

³⁶ European Blockchain Partnership

³⁷ European Blockchain Services Infrastructure

³⁸ <https://ec.europa.eu/digital-building-blocks/wikis/display/EBSI/Home>

³⁹ <https://digital-strategy.ec.europa.eu/en/policies/blockchain-partnership>

By creating a Blockchain Strategy⁴⁰ the EU wants to support a "gold standard" for blockchain technology in Europe that embraces European values and ideals in its legal and regulatory framework.

This blockchain "gold standard" includes:

- Environmental sustainability;
- Data protection;
- Digital identity;
- Cybersecurity;
- Interoperability.

To achieve the set standards, the Commission interacts with the private sector, academia and the blockchain community mainly through 2 organizations:

- The International Association for Trusted Blockchain Applications (INATBA⁴¹);
- European Blockchain Observatory and Forum.

Bulgaria also supports a "node" of the European blockchain infrastructure. The first tools and applications that can be used by Bulgarian citizens and the administration for more efficient cross-border public services are expected.

European personal digital wallet

The need for the development and implementation of a European personal wallet is presented as a priority task for the EU and the blockchain organizations of the Old Continent .

Need for blockchain for identity

The need to implement blockchain identity management systems to solve current identity issues such as: unavailability, data insecurity, fraudulent or false identities, etc. is analyzed.

Data uncertainty

The distribution network of the blockchain system, with a cryptographic algorithm and the decentralization of management is a solution for the security, integrity and credibility of data.

Fraudulent/false identity

With the implementation of cryptography and the advent of blockchain technology, there are the tools to build new identity management systems; digital identity frameworks based on

⁴⁰ <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy>

⁴¹ International Association for Trusted Blockchain Applications
<https://inatba.org/>

the concept of decentralized identities, potentially including a new subset of decentralized identities known as self-sovereign identities.

Ethereum's Decentralized Digital Identities

Blockchain technology allows users to create and manage digital identities through a combination of the following components: decentralized identities, identity management, and embedded encryption.

Digital identity

Digital identity arises from the use of personal information on the web and from the indirect data created by an individual's actions online. Data points that can help form a digital identity include usernames and passwords, driver's license number, online purchase history, date of birth, online search activities, medical history, etc. Biometric, behavioral and biographical are the patterns that build a person's identity.

Decentralized identifier

A decentralized identifier is a pseudo-anonymous identifier for a person, company, entity, etc. Each DID is protected with a private key.

Security of decentralized identities

The biggest problem with decentralized identity is how to ensure protection and security. Cryptography plays a key role.

Use of decentralized identity

Once paired with a decentralized identity, users can present the verified ID in the form of a QR code to prove their identity and access certain services.

Using Blockchain in Identity Management

➤ An independent sovereign identity

Sovereign Self Identity⁴² (SSI) is the concept that individuals and businesses can store their own identity data on their own devices.

➤ Data Monetization

Blockchain-based independent sovereign identities and decentralized models give users control and pave the way for data monetization.

➤ Data portability

⁴² Self- sovereign identity is an approach to digital identity that gives people control over the information they use to prove who they are across sites, services and applications on the web
https://en.wikipedia.org/wiki/Self-sovereign_identity

The European Union General Data Protection Regulation (EU GDPR) provides users with the right to data portability, which refers to the data subject's right to have their personal data transferred directly from one controller to another, where technically feasible.

Increasing economic contribution through blockchain

Analyses predict the adoption of digital identification to contribute significantly to economic growth worldwide.

The benefits of decentralized identity

Regulations such as the EU's General Data Protection Regulation⁴³ are strengthening identity standards that require modern solutions for its implementation.

The analysis shows three key aspects to modernize the public sector and they are as follows:

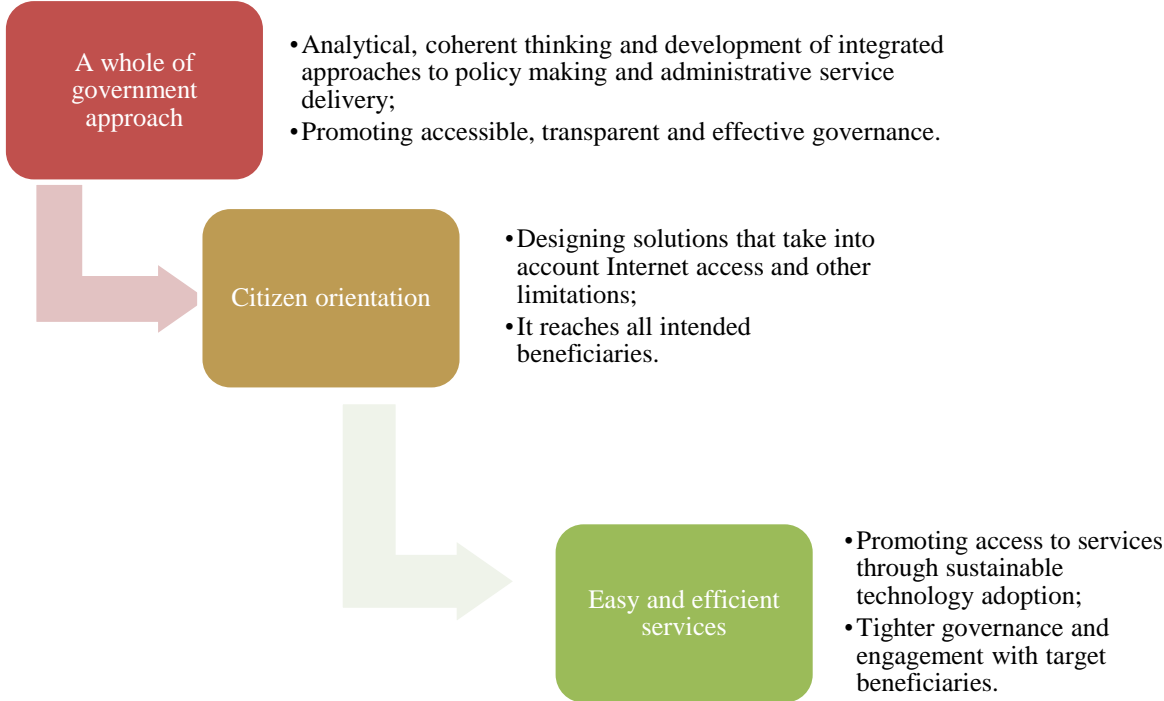


Figure 17. Key aspects of public sector modernization

2.3. Digital governments and blockchain technology

As stated in the European Council conclusions of 19 October 2017, blockchain is a key emerging trend that the European Union needs to promote while protecting personal data, rights and secure standards. The European Union agrees on the potential of blockchain technology to

⁴³ <https://gdpr-info.eu/>

increase the efficiency of digital governments and believes that blockchain technology has the potential to be a key backbone component of a reliable infrastructure for a global data economy⁴⁴.

Implementation of the blockchain system for administrative services enables them to be more efficient, secure, fast and reliable. The use of blockchain systems to increase security, increase speed and preserve the authenticity of information in security systems - record keeping, archival, reference, documentary – is an opportunity for optimization, efficiency and safety in the process of inevitable digitization.

Every effective government must have a comprehensive security plan, with information security as part of that plan, to protect its sensitive data and keep information credible, whole and untampered with. Three basic rules apply to management security:

1. Access control;
2. Encryption;
3. Threat detection.

Blockchain technology fully complies with these rules, and its application in both the public and private sectors is of paramount importance to ensure security in government.

2.4. Archives through the prism of blockchain technology

Archives, both analog and digital, have the primary function of preserving documentary wealth in its original form. It is for this reason that blockchain data structures are the logical choice when designing systems for non-tampering and data integrity.

Data authenticity and integrity are essential attributes of records and archives management. Integrity is a necessary condition for maintaining authenticity. And although there are many practical constraints (e.g. budget, technology, time, IT skills of archivists), it is necessary for national archival and archive institutions to apply blockchain to their records and archives management systems and to create a long-term plan to achieve such application . State funding, strategy and strategic plans are the beginning are the first steps towards the realization of this goal.

2.5. Smart border

In today's digital world, digital facilities are required to meet the influx of migrants crossing border checkpoints. The smart border is an updated version of an old idea: a virtual fence of cameras and sensors along the border line. All this data should be monitored in a

⁴⁴ Allessie , D. , Sobolewski , M. , Vaccari , L. , Blockchain for digital government , 2019, 12

command center with immediate response capabilities, regardless of the location of the breach and non-regulated border crossing point⁴⁵.

2.6. Law enforcement structures and new technological opportunities

It is no secret to anyone that the police structures in Bulgaria have a very low threshold of trust. Citizens do not even report violations because there is no sense in this "waste of time". There are two possible options for the structures of the Ministry of Internal Affairs and the intelligence services: use the digital capabilities of new technologies and build public trust, or continue the decline in citizens' trust and miss the opportunity to modernize their specialized activities.

Officers from these structures must have specialized skills and capacity to respond to increasingly sophisticated and inventive criminal organizations⁴⁶.

It is necessary for the field of policing to respond to the challenges of the digital world in which we live.

The smart policing solution will focus on areas where more help and intervention from the police is needed. At the same time, it ensures that the police are accountable by making their actions more transparent to all stakeholders.

The decentralized blockchain system improves the distribution of public data without being compromised, manipulated or subject to hacker attacks. With new technological capabilities, corruption problems are identified and security gaps in the police system are eliminated.

2.7. Blockchain in Government of the People's Republic of China

As I have already mentioned, the introduction of new technological opportunities in state administration and their transformation into priority goals is based on state policy and support for pilot initiatives and developments⁴⁷.

⁴⁵ Radulov, N., Scientific journal "Security and Defense", Ed. Vasil Levski University Complex, Veliko Tarnovo, 2022, ISBN 2815-388, 94 p.

⁴⁶ <https://pds.police.uk/national-policing-digital-strategy-2020/>

⁴⁷ On October 24, 2019, Xi Jinping, General Secretary of the Central Committee of the Communist Party of China, attended the 18th Political Bureau of the Central Committee. During the second collective survey, it was emphasized that accelerating the development of blockchain technological capabilities is a priority to promote high-quality economic and social development

With state support, information guides are issued, the so-called A blockchain white paper⁴⁸ to get stakeholders started with blockchain adoption innovations and trends in both the private and public sectors of government.

In 2020, the coronavirus pneumonia epidemic swept the world, and the uncertainty of global economic development faced a great challenge. The public and private sectors of various countries are beginning to explore the use of emerging technologies and to reduce economic and social operating costs, a consequence of the changed global environment. The cross-innovation of blockchain and new technological infrastructures, such as cloud computing and artificial intelligence, are increasingly real.

Development ideas are aimed at improving the economy and optimizing public services and the goal of the state government is how to solve the problems and challenges in the process of empowering the real economy⁴⁹.

With ecological construction and construction of the block system, the threshold for development and implementation should be reduced, the flexibility of users should be improved, and more development should be undertaken by users to build their own ecological barriers. For a period of time, the blockchain industry and technology development has mainly focused on engineering and environmental construction.

The need for reliable storage of data and information is increasing, and users expect to use easy-to-use blockchain universal products with a high degree of standardization. Different countries and regions are trying to build blockchain infrastructure for multiple organizations in the service area. Main representatives are EBSI of the European Union, the Inter-American Development Bank LACChain⁵⁰. Multi-cloud and inter-cloud BaaS services, open chains of consortia, etc. are used⁵¹ such as blockchain infrastructure⁵².

At this stage, blockchain technology is making innovations and breakthroughs in multiple directions, and industrial ecology is building stable government.

⁴⁸ Blockchain 白皮书, (2020) (White paper). Common name for an informational document, a guide that informs readers to understand and solve a problem

⁴⁹ Blockchain 白皮书, (2020 年), 4

⁵⁰ LACChain is a [global alliance](#) integrated for different participants in the blockchain chain, leader of the Laboratorio de Innovación del Grupo del Banco Interamericano de Desarrollo ([BID Lab](#)) to develop a blockchain ecosystem in America, Latin and the Caribbean

⁵¹ A model for providing web applications and mobile application developers and connecting their cloud storage with APIs

⁵² The People's Republic of China

Investment and funding in the global blockchain industry reached US\$3.16 billion with 457 transactions⁵³.

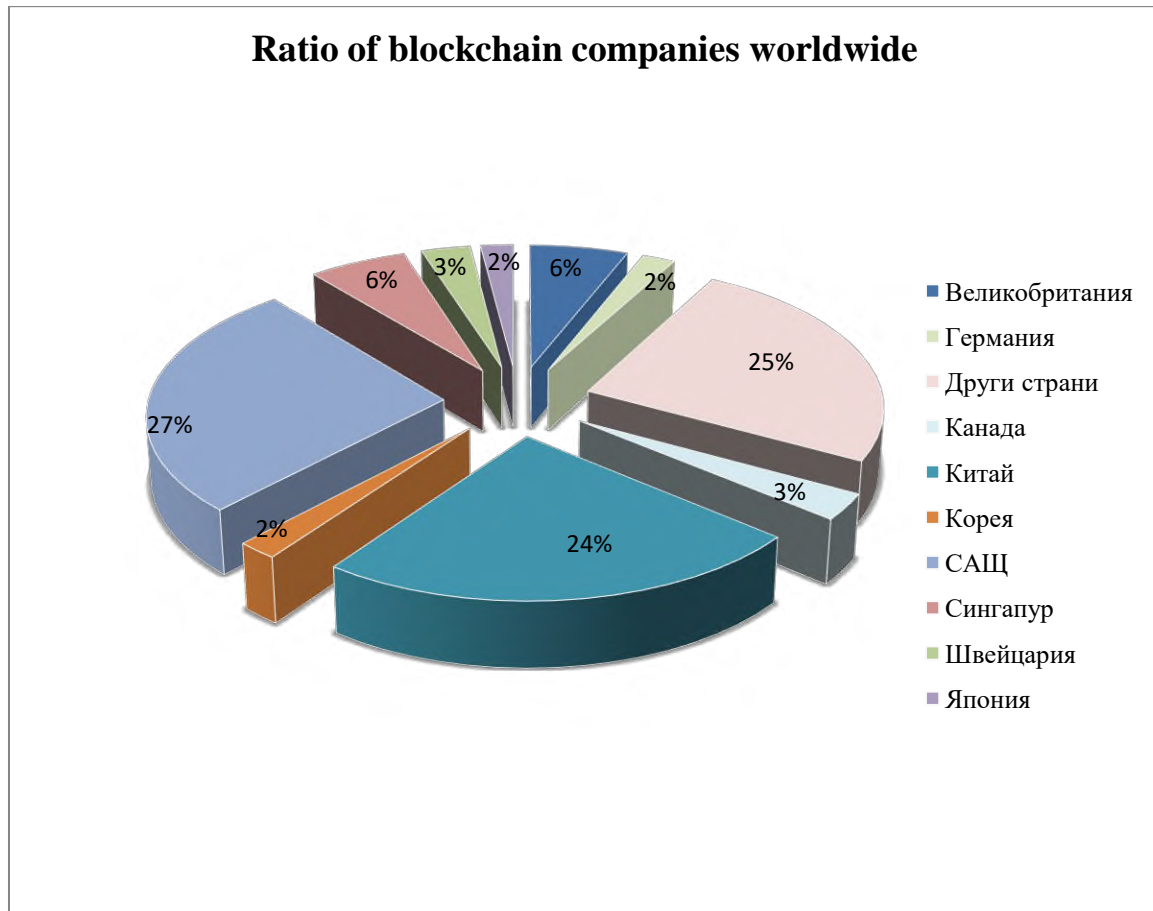


Figure 18. Ratio of blockchain companies worldwide, according to China Academy of Information and Communication Technology, October 2020⁵⁴

⁵³ Blockchain 白皮书, (2020 年), 5

⁵⁴ Blockchain 白皮书, (2020 年), 8

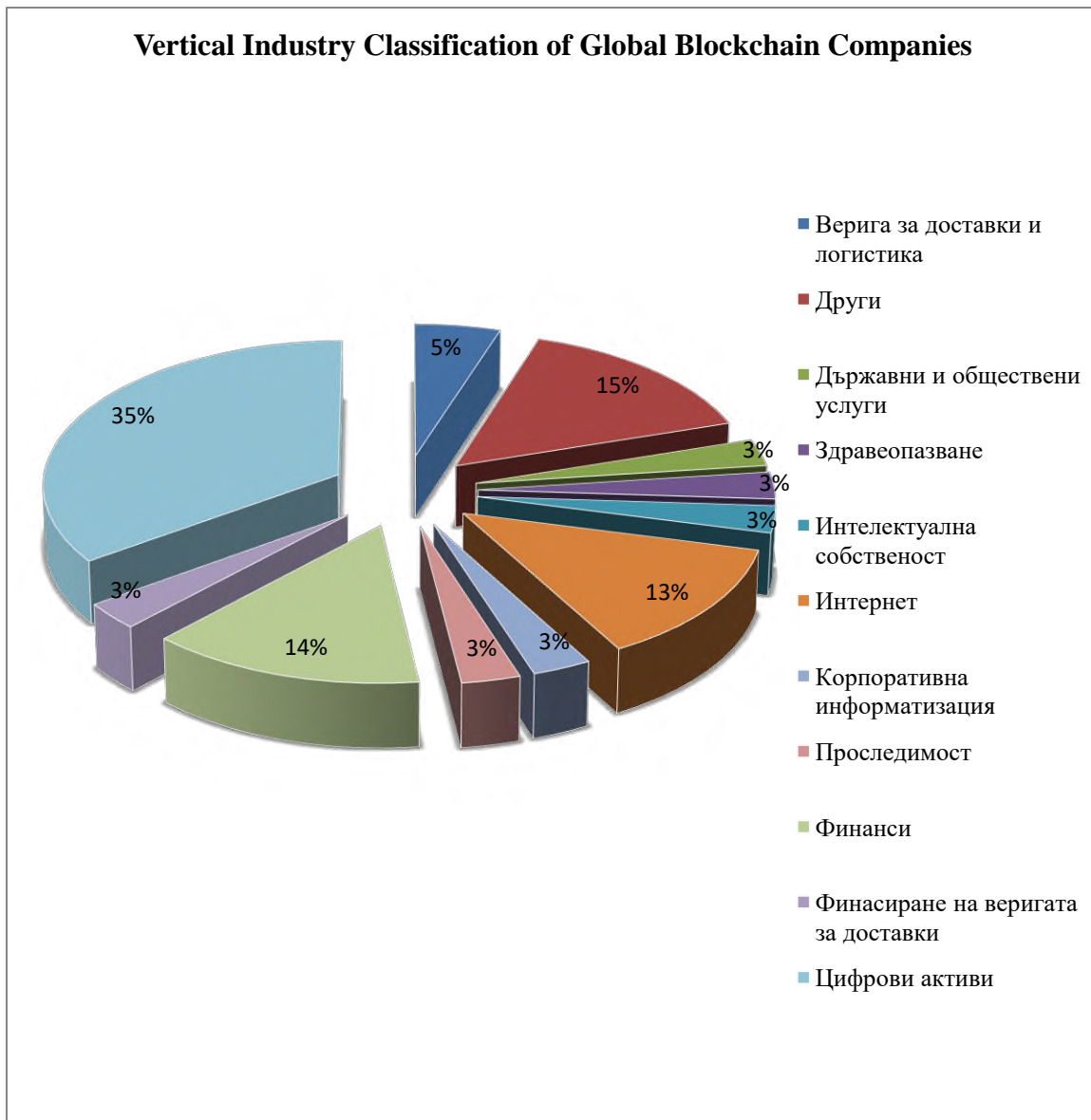


Figure 19. Vertical industry classification of global blockchain companies, according to China Academy of Information and Communication Technology, October 2020⁵⁵

Blockchain has an increasingly important role in economic recovery and the development of the digital economy, especially after the restrictions introduced by the coronavirus infection and breaking through in multiple directions, and the industrial ecology is building a stable government.

⁵⁵ Blockchain 白皮书, (2020 年), 8

3. Chapter Three. Blockchain based digital governance model

Today, governments are increasingly committed to the digitization of public services and their administration, with the aim of making administrative procedures simpler and more accessible. Overall, this digital transformation of public administration can have consequences beyond simply modernizing the state, transforming traditional governance models by being a tool for open governance. Indeed, the digital transformation of administrations can allow countries to evolve towards a more horizontal model of governance, relying on transparency and openness of public data, as well as encouraging collaboration with civil society in the design of public policies.

3.1. A change in the management model is needed

The governance model, in its current operation, uses human resources, technological equipment, materials, funds and time to benefit both the citizens and the structure itself. However, changes are occurring that are independent of the government itself. These factors lead to the obsolescence of the management model, the information system and the payment system and do not meet the required efficiency. Even the normal working environment leads to the need to make changes and the management to adapt to the changes of the dynamic environment and the interconnectedness that is all around us.

3.2. New public management

Digital technologies have profoundly affected social and economic realities, making the world more difficult to manage. These changes reached the public administration, including the so-called New Public Management⁵⁶ (NPM), a bureaucratic model that evolved from both the new institutional economics and the idea of managerialism, has been gaining traction in developed countries since the early 1980s.

New public management, based on managerialism, decentralization, debureaucratization, privatization, and downsizing of administration, peaked in the mid-2000s.

3.3. A vision for the digital governance model

Donors and partners are investing significant funding and human resources in digital governance initiatives in the hope that such initiatives will improve governance and service delivery. However, "proper digital governance is not only digital, but also accompanying analog processes, including strengthening state institutions and democratic norms and processes."

⁵⁶ Concept of new public administration/management (NPM) from Eng. New public management

aim to help government become more:

- Coordinated;
- Efficient;
- Sustainable;
- Responsive;
- Responsible;

The same digital investments that can support democratic institutions, rights-respecting government bodies, and open societies in one context can be used to suppress political dissent, abrogate individual freedoms and rights, and limit competition in the marketplace.

3.4. Core components of digital government

Governance or e-Governance involves the digitization of internal government processes and systems.

- Digital databases;
- data storage solutions;
- Management Information Systems⁵⁷ (MIS);
- Systems for electronic public procurement.

Provision or delivery of electronic services, includes the digitization of the provision of administrative services. Most commonly include include:

- Government portals;
- Digital payments;
- Digital identification systems (ID).

Engagement, or e-participation, includes digital channels and platforms through which stakeholders can collaborate and influence government agencies and policies. They most often include:

- Education of citizens and voters;
- Government supported incubation centers⁵⁸;

⁵⁷ A management information system (MIS) is a widely used and applied term for a three-resource system required to effectively manage an organization. Resources are people, information and technology from inside and outside an organization, with priority given to people. A system is a set of information management methods, including computer automation (software and hardware) or otherwise supporting and improving the quality and efficiency of business operations and human decision making

⁵⁸ Incubation centers support the synergy between science and business to support with modern models and solutions the needs of the private and public sectors.

On June 17, 2022, the first business incubator of Sofia Tech Park and the European Agency for Nuclear Research will be established - The Bulgarian Business Incubation Center
<https://bic.fitt.bg/>

- Open data portals, the so-called open data;
- Mechanisms for political participation;
- Citizen Science Initiatives.

3.4. Organizational architecture

The organization's architecture must enable digital governance whose technical components work together. This requires interagency coordination and standardization of processes, protocols, and policies. The overall corporate architecture enables the integration of systems and shared services between state administrative bodies. Sustainable connectivity infrastructure and communication environment systems are needed in government bodies operating at national, regional and local levels.

3.5. Stages of change management

The general model of change management covers a number of stages - from awareness of the need for change to assessment that it has been achieved.

- Planning the long-term management of digital systems;
- Planning of current costs and necessary personnel;
- Process integration;
- Business Process Ownership Planning;
- Data quality assurance;
- Ensuring ongoing data security.

3.6. Human capacity between government personnel, the private sector and individuals

- IT support to maintain, update and troubleshoot systems;
- Workforce Skills;
- Capacity among regulators, judges and lawyers;
- Digital literacy at all levels;
- Data oversight skills.

3.7. Adoption and implementation of enabling legislation, policy and regulations

The development of new technologies is ahead of legislative processes, and not only in Bulgaria. Of course, the lack of a legislative framework creates risks for both investment and stability in areas where blockchain is implemented.

The European Commission recognizes the importance of legal certainty and a clear regulatory regime in areas where blockchain-based applications are used⁵⁹.

At the EU level, there is a decision and it is in the application of a European regulation, which regulates the "issuance of financial instruments using the technology of the decentralized register"⁶⁰. This, in turn, at least temporarily relieves the need for European legislation on financial services.

Currently, there is no legal regulation in Bulgaria for the use of decentralized registry technology.

3.8. Considerations for digital infrastructure, access and use

The digital infrastructure must be based on optical networks and mobile networks with the 5 G standard⁶¹ and even higher standards. These standards are for broadband cellular networks. The new networks have higher download speeds and peak speeds. Higher bandwidth ensures fast speeds and connectivity to a variety of devices. The new technological standard begins to be implemented already in 2019, and modern security services must not lag behind the new possibilities in order to adequately counter criminal activity.

3.9. Contextual considerations

Digital government investments influence and are influenced by all aspects of the digital ecosystem, as articulated in the three pillars of USAID's Digital Ecosystem Framework⁶². The first pillar is digital infrastructure and adoption, which includes the resources that make digital systems possible. The second pillar is digital society, rights and governance, which includes digital interactions between government, media and civil society. The third pillar of the digital ecosystem is the digital economy, which is defined by factors such as digital financial services, e-commerce, the tech startup environment, and the digital talent pool.

3.10. Risks in Digital Governance Investments

Central to the risks of investing in digital governance is the possibility of repression, through the use of technologies for surveillance, censorship and social manipulation of citizens.

⁵⁹ <https://digital-strategy.ec.europa.eu/bg/policies/regulatory-framework-blockchain>

⁶⁰ Regulation (EU) 2022/858 of the European Parliament and of the Council of 30 May 2022 on pilot regulation of market infrastructures based on decentralized ledger technology

⁶¹ Fifth generation technology standard for cellular broadband networks
<https://en.wikipedia.org/wiki/5G>

⁶² US Agency for International Development

The restrictions that can be imposed on the rights of individuals concern each of us and we need a timely and clear justification for the introduction of changes in management.

3.11. The model of digital management through the prism of the management cycle

To apply the model of change in the management cycle, I will follow the logic of the management cycle in security⁶³. Most of the stages in the management of changes in public administration can happen by using the possibilities of new technologies.

1. Collection, arrangement and analysis of information;
2. Forecasting, forecasts and estimates;
3. Preparation of options for management decisions;
4. Making management decisions;
5. Planning;
6. Organization and implementation;
7. Control.

The use of new technological possibilities changes the management model itself, and it becomes more secure, efficient and leading to expected results. Modern management needs to initiate and create virtual models at the operational, tactical and strategic levels in order to have an advantage over criminal organized groups. On the other hand, standard routine operations can be performed through technological capabilities, for example, from smart contracts, and thus direct human resources to substantive and mental, analytical activity.

3.12. The model of digital governance according to the ministerial architecture in Bulgaria

Digital transformation is a necessary process of technological development in Bulgaria to create conditions for innovation and business growth, increasing the efficiency of the workforce, a competitive digital economy and a high standard of citizens⁶⁴.

In the development, I pay attention to the number of provided electronic administrative services⁶⁵, as well as to the strategic and normative documents, in terms of transformation in management, of the primary bodies of the executive power that manage a specific sector of the public administration.

Information systems in administrations

⁶³ Radulov, N. Security 4.0, Ed. NTS of Mechanical Engineering "Industry 4.0", Sofia, 2019, ISBN 978-619-7383-15-7, 307 p.

⁶⁴ https://www.mtc.government.bg/sites/default/files/cifrova_transformaciya_na_bulgariya_za_perioda_2020-2030.pdf

⁶⁵ The presented number of electronic administrative services is current as of July 2023 (b.a.)

Information systems in the state administration are an important prerequisite for the automation of internal administrative processes and for the implementation of operational activities. All administrative structures report that they have an accounting information system.

Table 3. Administrations that do not have implemented information systems⁶⁶

<i>Administrations that have NOT implemented IT systems</i>	<i>2020 %</i>	<i>2021 %</i>	<i>2022 %</i>
<i>Administrative information systems/ System for document circulation</i>	<i>5.79</i>	<i>5.45</i>	<i>3.10</i>
<i>Human resource management system</i>	<i>25.7</i>	<i>23.51</i>	<i>22.4</i>
<i>Labor and wage system</i>	<i>2.4</i>	<i>2.7</i>	<i>1.20</i>
<i>Accounting system</i>	<i>1.2</i>	<i>1.4</i>	<i>0.00</i>
<i>Database Management System</i>	<i>46.5</i>	<i>45.8</i>	<i>41.90</i>
<i>Document, flow and content management systems over the WEB</i>	<i>46.7</i>	<i>44.5</i>	<i>43.20</i>
<i>AIS for complex administrative services</i>	<i>71.7</i>	<i>69.3</i>	<i>66.70</i>
<i>System for legal information services</i>	<i>16.9</i>	<i>16.6</i>	<i>15.80</i>

State Hybrid Private Cloud

The state hybrid private cloud (DHPC) is a centralized state information infrastructure (servers, data storage facilities , communication equipment, engineering and technical equipment and system software), distributed in several locations in premises that meet the criteria for building protected information centers, which provides physical and virtual resources for use and administration by state authorities, while guaranteeing a high level of security , reliability, isolation of individual users and the impossibility of interfering with the functionality of their information systems or unauthorized access to their information resources⁶⁷.

⁶⁶ https://egov.government.bg/wps/wcm/connect/egov.government.bg-2818/98f0ba0a-51a2-4169-92e8-5415054636ae/%D0%9E%D0%A2%D0%A7%D0%95%D0%A2-%D0%98-%D0%9F%D0%9B%D0%90%D0%9D-%D0%98%D0%A0_2023.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_PPGAHG800PLV6060GL92MR3OU3-98f0ba0a-51a2-4169-92e8-5415054636ae-oujYPSU#page=5&zoom=100,62,72

⁶⁷ Updated strategy for the development of e-government in the Republic of Bulgaria 2019-2025.

It is one of the main components of the shared resources of e-government, through which information resources (hardware and system software) are provided and configured to build information systems providing electronic services for citizens and businesses. Their effective use depends to a large extent on the provision of sufficient funds to maintain a high technological level and to develop a critical mass of users and services. Data centers are included in the scope of DHPO⁶⁸.

Table 4. List of state organizations using resources in the DHCHO⁶⁹

<i>State organization</i>
Executive Agency "E-Government Infrastructure"
Council of Ministers
Ministry of Regional Development and Public Works
Fisheries and Aquaculture Executive Agency
State Agency "Road Safety"
State agency for metrological and technical supervision
Ministry of Innovation and Growth
Ministry of Transport and Communications
Public Procurement Agency
Ministry of Economy and Industry
Ministry of Health
Forestry Executive Agency
National Statistical Institute
Hail Control Executive Agency
Communications Regulatory Commission
Ministry of e-Governance
Commission for the Protection of Competition
Bulgarian Post Office
Ombudsman of the Republic of Belarus

⁶⁸ Data centers are built in engineering and technical facilities and are intended to provide information resources for the needs of e-government with a high level of availability and security

⁶⁹ https://egov.government.bg/wps/wcm/connect/egov.government.bg-2818/98f0ba0a-51a2-4169-92e8-5415054636ae/%D0%9E%D0%A2%D0%A7%D0%95%D0%A2-%D0%98-%D0%9F%D0%9B%D0%90%D0%9D-%D0%98%D0%A0_2023.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18PPGAHG800PLV6060GL92MR3OU3-98f0ba0a-51a2-4169-92e8-5415054636ae-oujYPSU#page=5&zoom=100,62,72

The Prosecutor's Office of the Republic of Belarus

National Assembly

Ministry of Agriculture

Central Election Commission

Troyan municipality

Ministry of Environment and Water

Ministry of Youth and Sports

State Agency "Archives"

Executive Agency "Audit of European Union Funds"

Bulgarian national radio

Financial Supervision Commission

Ministry of Labor and Social Policy

Ministry of Tourism

A European political program "Digital Decade" has been developed, with which it aims to implement four main policy areas of digital transformation by 2030: digital skills, digital connectivity, digitization of enterprises and

In the National development program BULGARIA 2030⁷⁰ an index for the penetration of digital technologies in the economy and society (DESI ⁷¹) has been created . The DESI is a composite indicator that tracks the progress made by EU Member States in digitalisation. It is structured in five chapters: Connectivity, Human capital, Internet use, Adoption of digital technologies, Digital public services. The evaluation scale is from 0 to 100, where 100 means that digital technologies are fully implemented in the economic and social life of the population⁷². As of Dec. 31 2019, this index is 36.2, the goal is to reach the EU average of 52.5 by 2030.

Conclusion

The main goal and task of the dissertation work - a scientific research study of the problem of modernization of the administration, through the blockchain system, for a modern and

⁷⁰ https://egov.government.bg/wps/wcm/connect/egov.government.bg-2818/70439d45-e298-47e1-9cd2-1da345a4e752/Bulgaria%2B2030.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_PPGAHG800PLV6060GL92MR3OU3-70439d45-e298-47e1-9cd2-1da345a4e752-nZPQO1P

⁷¹ Digital Economy and Society Index

<https://digital-strategy.ec.europa.eu/en/policies/desi>

⁷² https://egov.government.bg/wps/wcm/connect/egov.government.bg-2818/70439d45-e298-47e1-9cd2-1da345a4e752/Bulgaria%2B2030.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_PPGAHG800PLV6060GL92MR3OU3-70439d45-e298-47e1-9cd2-1da345a4e752-nZPQO1P

responsive state government in Bulgaria, was achieved as a result of in-depth collection and analytical work with the use of analyzes of scientists from the USA, Europe, People's Republic of China, South Korea and other countries and the available publications and methodologies for implementing and using new technological opportunities. The regulatory framework (directives and strategies) of the EU, fixing the policy of the Union in the field of blockchain, has also been added.

Blockchain technology continues to evolve and may eventually change core government activities and functions, such as information certification, financial transactions, and citizen identification. Changes in these areas have the potential to fundamentally affect the government's role as a trusted repository of information or keeper of records. Government leadership should monitor and monitor how the blockchain system matures and is implemented over time to ensure that records management issues are identified and addressed.

The proposed practices are fully applicable in all state and municipal administrations, as well as the Ministry of Internal Affairs, security services, despite the specifics of their activities, and fully meet the level of security, reliability and authenticity guaranteed by blockchain technologies.

III. Scientific publications on the subject

III.1. Monographs

1. "Digital transformations in archival work", Ed. Technical Technical University of Mechanical Engineering "Inductria-4.0", Sofia, 2022, ISVN 978-619-7383-27-0
2. "Modern Security in Management", Ed. Technical University of Mechanical Engineering "Inductria-4.0" Sofia, 2023, ISVN 978-619-7383-30-0

III.2. Articles

1. "BLOCKCHAIN TECHNOLOGIES - INFORMATION SECURITY IN ARCHIVISTICS", In "Security and Defense" magazine, 2022, year I, issue 2, pp. 235-251, ISSN 2815-388 X;
2. "IMPLEMENTATION OF BLOCKCHAIN IN THE PUBLIC SECTOR AND INFORMATION SECURITY", In "Security and Defense" magazine, 2023, year II, no. 1, pp. 223-235; ISSN 2815-388 X;
3. "BLOCKCHAIN AND SECURITY ECOSYSTEM", V. Sb. Doc. from the scientific conference "Current Security Issues" - Oct. 27-28. 2022 , pp. 141-148, ISSN 2367-7473;

4. "INFORMATION SECURITY IN STATE ADMINISTRATION THROUGH BLOCKCHAIN", V. Sb. Doc. from the scientific conference "Current Security Issues" - Oct. 27-28. 2022 , pp. 951-959, ISSN 2367-7473;
5. " INFORMATION SECURITY IN ARCHIVAL SCIENCE ", V. Sb. Doc. from the VI International Scientific Conference on Security " CONFSEC 2022 " - Dec. 5-8 2022 , pp. 59-61, ISSN 2603-2953;
6. "THE BLOCKCHAIN SYSTEM - A CHALLENGE OF INFORMATION SECURITY", V. Sb. Doc. from the VI International Scientific Conference on Security " CONFSEC 2022 " - Dec. 5-8 2022 , pp. 62-65, ISSN 2603-2953;
7. "DATA SECURITY WITH BLOCKCHAIN TECHNOLOGY" V. Sb. Doc. from the annual scientific conference of VTU "Vasil Levski" - June 8-9, 2023 , pp. 381 - 390 , ISSN 2367-74 81 ;
8. "DIGITAL TRANSFORMATION AND INFORMATION SECURITY IN THE PUBLIC AND PRIVATE SECTOR" V. Sb. Doc. from the annual scientific conference of VTU "Vasil Levski" - June 8-9 , 2023 , pp. 39 1-401 , ISSN 2367-74 81 ;
9. "SECURITY AND CONTROL OF PERSONAL DATA WITH BLOCKCHAIN" V.. Sat. Doc. from the international scientific conference "Rights and Security" of the New Bulgarian University - April 27-28. 2023 , official note;

IV. Literature used for writing the abstract

In Cyrillic

1. Updated strategy for the development of e-government in the Republic of Bulgaria 2019-2025.
2. Genkin, A., Mikheev, Al. Blockchain: How it works and what will happen to you tomorrow, Moscow, 2018, 35 p.
3. Radulov, N. Security 4.0, Ed. NTS of Mechanical Engineering "Industry 4.0", Sofia, 2019, ISBN 978-619-7383-15-7, 307 p.
4. Radulov, N., Scientific journal "Security and Defense", Ed. Vasil Levski University Complex, Veliko Tarnovo, 2022, ISBN2815-388, 94 p.

In Latin

5. Allesie , D. , Sobolewski , M. , Vaccari , L. , Blockchain for digital government . 2019
6. NARA, BlockchainWhitepaper, 2019

7. Wang, H.; Yang, D. Research and Development of Blockchain Record keeping at the National Archives of Korea. Computers 2021.

In Chinese language

8. Blockchain White Paper (白皮书, 2020)

Internet sources

9. <https://academy.binance.com/zh/articles/what-are-smart-contracts>

10. [https://baike.baidu.com/item/%E6%99%BA%E8%83%BD%E5%90%88%E7%BA%A6/19770937#reference-\[1\]-20423455-wrap](https://baike.baidu.com/item/%E6%99%BA%E8%83%BD%E5%90%88%E7%BA%A6/19770937#reference-[1]-20423455-wrap)

11. <https://digital-strategy.ec.europa.eu/bg/policies/regulatory-framework-blockchain>

12. <https://digital-strategy.ec.europa.eu/en/policies/blockchain-partnership>

13. <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy>

14. <https://ec.europa.eu/digital-building-blocks/wikis/display/EBSI/Home>

15. https://egov.government.bg/wps/wcm/connect/egov.government.bg-2818/98f0ba0a-51a2-4169-92e8-5415054636ae/%D0%9E%D0%A2%D0%A7%D0%95%D0%A2-%D0%98-%D0%9F%D0%9B%D0%90%D0%9D-%D0%98%D0%A0_2023.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_PPGAHG800PLV6060GL92MR3OU3-98f0ba0a-51a2-4169-92e8-5415054636ae-oujYPSU#page=5&zoom=100,62,72

16. https://egov.government.bg/wps/wcm/connect/egov.government.bg-2818/70439d45-e298-47e1-9cd2-1da345a4e752/Bulgaria%2B2030.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_PPGAHG800PLV6060GL92MR3OU3-70439d45-e298-47e1-9cd2-1da345a4e752-nZPQO1P

17. <https://en.wikipedia.org/wiki/5G>

18. https://en.wikipedia.org/wiki/Ralph_Merkle

19. https://en.wikipedia.org/wiki/Self-sovereign_identity

20. <https://gdpr-info.eu/>

21. <https://komodoplatfrom.com/en/academy/blockchain-technology-types/>

22. <https://pds.police.uk/national-policing-digital-strategy-2020/>

23. <https://rich01.com/what-is-smart-contract/>

24. <https://thedocs.worldbank.org/en/doc/009c961203ebfc131b28feca946c7a3d-0350012021/original/Lemieux-World-Bank-GovTech-Presentation.pdf>

25. <https://www.guru99.com/blockchain-tutorial.html#1>

26. <https://www.ibm.com/topics/smart-contracts>
27. [https://www.mtc.government.bg/sites/default/files/cifrova transformaciya na bulgariya za perioda 2020-2030.pdf](https://www.mtc.government.bg/sites/default/files/cifrova_transformaciya_na_bulgariya_za_perioda_2020-2030.pdf)
28. <https://www-boozallen-com/s/insight/blog/3-potential-benefits-of-government-blockchain.html? x tr sl=en& x tr tl=bg& x tr hl=bg& x tr pto=sc>
29. <https://www-ibm-com/topics/blockchain-security? x tr sl=en& x tr tl=bg& x tr hl=bg& x tr pto=sc>
30. <https://bic.fitt.bg/>
31. <https://digital-strategy.ec.europa.eu/en/policies/desi>
32. <https://medium.com/coinmonks/a-beginners-guide-to-understanding-the-blockchain-part-4-public-vs-private-blockchains-37ff950ccb47>
33. <https://www.foley.com/en/insights/publications/2021/08/types-of-blockchain-public-private-between>