Digitization in the Era of Coronavirus – A Review

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Abstract: In the modern world, the development of technology has a significant impact on various areas of human functioning. However, the appearance of the COVID-19 coronavirus pandemic and the need to implement numerous restrictions resulted in an even greater increase in the importance of new technologies, especially in such sectors as education, administration, or finance. In Poland, the introduction of the remote work system encountered many difficulties related to the unpreparedness of previous structures to implement such solutions. An example of a country where they operate efficiently, responding to the problems that Poland faces today, is Estonia, in which, beginning from 2004, the state administration sector has been gradually replaced by a digital system based on Blockchain technology. At present, in Poland, appropriate steps are already taken by the Ministry of Digitization to digitize public administration in the form of a plan of four streams. Given the protracted pandemic, the possibilities for immediate solutions and considering the advantages and disadvantages of digitizing the state seem worth attention.

Keywords: *COVID-19, digitization, Blockchain, e-Government, X-road*

Introduction

In a world of constant technological development, society strives for increasing data security and the stability of information systems. In the face of the COVID-19 coronavirus pandemic, digitization turns out to be an essential factor in the functioning of society. Given the ever-increasing number of infections, further restrictions are introduced, and people are forced to study and work remotely. However, it should be remembered that digitization brings both challenges and opportunities, which was discussed by Almeida, Santos, and Monteiro (2020), who concentrated on three business areas: labor and social relations, marketing and sales, and technology.

One possible solution seems to be Blockchain – a technology that appeared on the market relatively recently. In principle, it seems to be an ideal solution; however, the difficulty of its implementation and high costs mean that developers and companies are still reluctant to use it. It also results from the lack of extensive technical documentation and thus – hindered access to in-depth knowledge about this technology.

COVID-19 – Reality in Poland

The first case of infection with coronavirus was found on March 4, 2020, in a hospital in Zielona Góra, where a 66-year-old man who came by coach from Germany was diagnosed with this disease. Several days after the patient was diagnosed, steps were taken to prevent the further spread of the virus. All mass events were canceled beginning from March 10, and schools and colleges closed on March 12. From March 14 to 20, the epidemic was in force in Poland, and from March 15, a sanitary cordon was introduced on Polish territory. According to the Minister of Health regulation, an epidemic has been in force in Poland since March 20. At the end of October 2020, over 300,000 cases of infection were recorded (Information provided by the Ministry of Health).

The situation surprised everyone, making a smooth transition to work online and distance learning impossible. Due to the lack of technological preparation of both schools and workplaces, it was not adapted to work in a mode other than stationary. Initially, classes for pupils and students were suspended, and employees were sent on partially paid leaves. With time, however, it turned out that this is not a temporary state but a form of functioning in society in which one has to learn to function. Communication services such as Zoom, Microsoft Teams, and Discord have become popular. Schools and corporations focused on complete digitization and, if possible, adapting to the current realities of online functioning. However, it is important to remember that – as indicated, e.g., by Nguyen et al. (2020) – changing communication methods to primarily digital is associated with increasing social inequalities, for example, in digital competence, which needs to be addressed.

The coronavirus pandemic has directly contributed to the growing interest of Poles in e-services, e-administration, and other solutions in the area of digitization. The effect of the COVID-19 crisis is the development of existing initiatives and the creation of new opportunities for the safety and comfort of citizens. The crisis related to the coronavirus pandemic contributed to the popularization of e-services and the greater use of other digital solutions by millions of Poles. It is due to the constraints imposed on society by the spread of COVID-19 and the shift to remote work. Therefore, the Ministry of Digitization decided to meet the challenges by creating new opportunities adequate to the pandemic reality and developing the already existing initiatives with the needs of citizens in mind (Katz, Callorda, and Jung, 2020).

Blockchain Technology – The Basics

When considering the digitization of public administration, one should first consider the security and stability of the IT system. One possible solution seems to be Blockchain – a distributed database containing an ever-growing amount of information. Thanks to decentralization and the applied peer-to-peer technology, the entire structure is a secure form of data storage. Information records are stored in blocks. Each subsequent block contains the time of its creation and a reference to the previous block, which contains encrypted information about it. A characteristic feature of such a system is an unbreakable blockchain. As a result, trying to change an already attached block will modify all other blocks in the chain, which is not possible (Homa, 2015, pp. 29).

Network transaction approval, or popular mining, is the process by which parties participating in a Blockchain-based network agree to a transaction approved by all participants in that network (Homa, 2015, pp. 35-36). Three methods are used to validate a block in the chain: Proof of Work (PoW), Proof of Stake (PoS), and Proof of Existence (PoE).

- *PoW* is the original Blockchain consensus protocol that allows to confirm transactions and create new blocks. In this method, the factor determining the share in mining is the computing power of the miner's graphics processors.
- *PoS* is a protocol in which the balance of current funds in the wallet determines the chance of approving individual transactions. This technique does not require huge computing power but only a block of funds. The algorithm is adjusted in such a way as to prevent a monopoly on mining in the area of a specific Blockchain.
- *PoE* is a network service that verifies computer files over a while. It is done by reading the timestamp on the blockchain (De Angelis et al., 2018).

Blockchain Technology Application

Blockchain's main goal is to enable fast and secure transactions regardless of distance. For this purpose, cryptocurrencies were created in which this technology was applied for the first time (Nakamoto, 2008). Technological development and interest in the opportunities offered by Blockchain have resulted in a significant increase in the number of cryptocurrency exchanges and the cryptocurrencies themselves. The dynamic development of the market is caused by the ease with which anyone can create their own cryptocurrency and introduce it to the market. Thanks to Blockchain's public and private key techniques, data can be transferred online easily and cheaply. In addition to transaction security, the use of this solution allows solving the problem of data validation (Homa 2015, pp. 32-33).

An excellent example of introducing this technology into everyday life is the e-Estonia public administration project implemented in Estonia. In spring 2007, after the election won by the Estonian Reform Party, in order to emphasize the autonomy of the former USSR, the government decided to move the monument of the so-called The Bronze Soldier. As a result,

Russian cybercriminals blocked all banking, news, and government websites in Estonia for several days, totally paralyzing the state. After these dramatic events, the authorities of the Baltic state decided to implement the X-road system into the public infrastructure, which was secured with Blockchain technology. The website provides services such as e-Voting (online voting), e-Tax Board (tax settlement), e-Ticket (tickets), e-Banking (electronic banking), and many others (Walewski, 2018). According to estimates, the digitization of the entire public administration has contributed to the issuing of 98% of online prescriptions, 94% of ID cards are digital, and Estonian citizens have already deposited 24 million digital signatures, which made it possible to generate savings of about 2% of GDP (Browne, 2017). There is also a plan to introduce Estocoin, a cryptocurrency intended for foreigners, to encourage investors to create innovative companies (e-Estonia, 2021).

Estonia is a pioneer in implementing Blockchain technology, though it is not the only state using this solution. In 2017, Luxembourg decided to build a government system based on Blockchain technology, implemented under the European Horizon programme (Trustnodes, 2018). Georgia, Sweden, and Malta are other examples of countries using Blockchain solutions. Georgia and Sweden have implemented Blockchain for land ownership registration and real estate transactions. Meanwhile, in Malta, this technology serves to improve education. In this way, diplomas and school certificates are managed, which results in increased security of personal data. In addition, bureaucracy is minimized, and students have easier and more transparent access to important documents (Clavin et al., 2020).

Implementation of Digitization

An essential aspect of transferring many areas of social life to the web is an appropriate approach and action plan. It is necessary to create a dedicated IT environment, which will be appropriately secured, and its operation will be very stable. Only such prepared software can be used to place e-services on it. To do this, one needs much money, a long-term investment, qualified employees, including programmers, and cooperation between government units and business owners (Katz, Callorda, and Jung, 2020).

Modern digital technologies determine the innovativeness and competitiveness of the economy. Their use in the public sector and economic turnover constitutes the level of socio-economic development of countries. Currently, the programme "From paper to digital Poland" is being implemented in Poland, run by the Ministries of Development, Digitization, Finance, Infrastructure, and National Education, aiming to develop the e-state and digitization of the economy. According to government reports, the implementation of the programme brings tangible benefits for citizens and entrepreneurs. It leads not only to convenient handling of official matters, faster and cheaper administrative processes but also to increasing tax revenues and reducing the shadow economy in the economy (Żak, 2016).

On the government website, the Ministry of Digitization lists nine working streams:

- *Digital Public Services* – support for the Ministry of Digitization in designing new digital public services, optimizing the functioning of existing e-services, and developing standards and guidelines for the construction and operation of digital public services.
- *E-Education* – a modern education system implementing the creation and dissemination of IT tools, improving the education process of children and adolescents, seniors, and disabled people.
- *Distributed registers* – works on the implementation and subsequent popularization of Blockchain technology in administration and various sectors of the economy.
- *E-Transport* – standardization of transport and customs data exchange in global supply chains according to the requirements of e-Freight Common Framework for ICT and simplification of administrative, customs, port, and transport procedures.
- *Increasing Cashless Turnover* – limiting cash circulation in the economy by introducing a statutory obligation to accept payments with an electronic instrument.
- *E-Receipt* – digitization of document circulation in public procurement and trade through, among others, the implementation of B2A and B2B e-invoicing.
- *E-Education* – a modern education system implementing the creation and dissemination of IT tools, improving the education process of children and adolescents, seniors, and disabled people.
- *Artificial Intelligence* – covers activities in the data economy, research and market financing, education, ethics, and human rights.
- *Internet of Things* – the main goal is to remove legal barriers to the development of the economy in this technology and introduce regulations stimulating the market and facilitating cooperation between enterprises (Ministry of Digitization, 2020).

It is worth adding that the lack of technology enabling precise detection of new COVID-19 infection outbreaks and the need to constantly predict the risk of coronavirus infection increase the problem that governments have with stopping the pandemic. Perhaps Blockchain could contribute to creating solutions that would enable an effective fight against the crisis in the context of COVID-19. Decentralization, transparency, and immutability – the important aspects of this technology – can help control a pandemic (Sharma et al., 2020). Creating a system could enable the early detection of illnesses, fast-tracking drug delivery, and the protection of user privacy during treatment.

Limitations and Future Directions

This article is an introduction to the use of Blockchain technology in various areas of life. Due to the desire to show different application areas, it was impossible to discuss each of the mentioned areas in depth. An interesting direction for further exploration would be a detailed look at the implementation of specific Blockchain-based solutions.

Conclusion

The COVID-19 pandemic has forced societies around the world to learn to live in a completely new, previously unknown reality. Although Blockchain technology has only 11 years, many authorities and developers saw its potential with great development opportunities. The example of Estonia shows how much modern society can achieve by basing public administration on Blockchain-based systems. In Poland, some solutions like various e-services or distance learning have been implemented. It seems, however, that ensuring the efficient functioning of the state and its development in various sectors requires the implementation of many more changes and openness to the search for new solutions.

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