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The specificity of the digital transformation of the public sector

In this article we focus on identifying the specificity of digital transformation within the public sector. The aim of the article is to present the main mechanisms resulting from the introduction of digital innovations that have changed the functioning of the public sector. Starting from a discussion on the technological requirements of digital transformation, we briefly characterise the use of computers and the Internet in public administration, resulting in the development of e-services and administration. The main part of the article is devoted to discussing the specificity of the implementation of the new digital technologies in public administration, focusing mainly on artificial intelligence and blockchain technologies. Our thesis is that the impact of innovative digital technologies on the operation standards and structure of public administration should be analysed through the prism of interrelated mechanisms of datafication and platformisation, characteristic for the digital economy. The adopted methodology, which is based on an analysis of the subject literature and an analysis of new technology implementations in public administration in EU countries, indicates the pilot, random and non-transformational nature of these implementations, partly due to the lack of well-established methodologies to study and assess the maturity of digital transformation within the public sector.

Key words: artificial intelligence, blockchain, digital, e-services, public sector, transformation

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Technological aspects of digital transformation

The acceleration of the digital transformation of the economy, society and the state is due to the increasing use of interrelated technologies, which can collectively be referred to as digital technologies. They are used to collect, store, process and analyse data continuously produced by consumers and citizens, private organisations and public institutions, by people and machines, who/which are more and more often permanently connected to the Internet. In other words, it is a specific group of information and communication technologies that we propose to refer to as "intensifying technologies". This is because they strengthen the impact of those ICTs (information and communications technologies) whose diffusion has laid the foundations for the digital economy, and can therefore be referred to as "foundational technologies". First and foremost, computers are such foundational technologies – complex computing machines working on the basis of algorithms. Over the last few decades, computers have become increasingly efficient and powerful, while becoming smaller and therefore more mobile, all thanks to advances in chip miniaturisation. Another epochal invention, the Internet, has ensured communication between individual computers. Finally, several years ago, smartphones appeared on the market – the multifunctional devices being in fact miniature, Internet-connected computers, constantly downloading and sending data. Miniaturisation has also contributed to a decline in price and a resulting surge in the use of sensors, devices that pick up signals from the environment and convert them into data. The volume of digital data coming from digital devices has started to grow exponentially.

A parallel progress in the area of connectivity has enabled the development of two key "intensifying technologies": cloud computing solutions, which allow one to increase computing power by using the computational potential of external servers; and the so-called "Internet of Things", which consists in connecting devices equipped with sensors within the Internet. Through the cloud, an organisation can use disk space and computing power (Infrastructure-as-a-Service, IaaS); applications and software (Platform-as-a-Service, PaaS, and Software-as-a-Service, SaaS); communication solutions (Communication-as-a-Service, CaaS) and the infrastructure that integrates programs and applications running in different operating environments (Integration Platform-as-a-Service, iPaaS). In fact, everything can become a cloud service (Everything-as-a-Service, XaaS).[1] The Internet of Things makes it possible to collect real-time data on the entire life cycle of a product, from production through use to recycling; it also makes it possible to create digital twins of machines and systems, *i.e.* digital replicas that allow changes to be made to their functioning on an ongoing basis.

1 S. Vennam, *Cloud Computing*, IBM.com 18 August 2020, https://www.ibm.com/cloud/learn/cloud-computing (online access: 21.12.2020).

Artificial intelligence and blockchain

Artificial intelligence (AI) is a lofty term proposed in the 1950s by one of the pioneers of research into "thinking machines"; in fact, it is a group of technologies based on the use of algorithms. These algorithms can be rule-based, *i.e.* they can follow the "if a certain condition occurs, perform a certain action" guidelines imposed by the programmer, or they can self-improve using statistical rules. In this case we are dealing with machine learning: computers work without being programmed first. However, the effectiveness of such algorithms depends on access to large data sets, which have only become available with the development of the Internet and the diffusion of digital devices.

In 2012, "intelligent" algorithms created by Google X Lab learned to recognise cats in photos; however trivial the subject may seem, it was an excellent example of the potential of artificial intelligence, currently being developed for such purposes as biometric identification and the creation of autonomous vehicles capable of analysing the environment in real time and responding to changes in it accordingly. Complex, multi-layered algorithms, somewhat resembling the structure of the human brain, are able to detect connections and correlations in large data sets: each subsequent layer of the algorithm strengthens the result of the analysis made in the previous layer. Such neural networks enabling deep learning proved their capabilities in 2016 when a program created by Google-linked DeepMind beat a human master at the ancient Chinese game of "go", a much more complex game than chess. The program, fed by a database of historical games played and provided with the rules of the game, reached master level in three days by playing a million games against itself. The next iteration, AlphaGo Zero, is equipped only with a database of games; by testing various solutions, the program has developed rules of play to beat both human and computer champions.[2] This is an example of reinforced deep learning, highlighting the cognitive potential of algorithms. For the sake of argument, it should be added that the widespread use of such algorithms is still limited due to the enormous cost of their operation (resulting from the need to clean and customise databases and the cost of electricity needed to process the data).[3]

The increase in computing capabilities of computers thanks to cloud solutions has enabled the development of blockchain technology. A blockchain is a cryptographically secured, distributed data record, a kind of "digital ledger that operates within a decentralised network of independent computers that update and maintain it in a way that proves the records are complete and authentic".[4] The blockchain's operating protocol is based on an innovative algorithm that enforces the consensual entry of subsequent

2 D. Hassabis, D. Silver, *AlphaGO Zero: Starting from scratch*, DeepMind 18 October 2017, https://deepmind.com/blog/article/alphago-zero-starting-scratch (online access: 21.12.2020).

3 K. Greenewald, K. Lee *et al.*, *The Computational Limits of Deep Learning*, 10 July 2020, https://arxiv.org/abs/2007.05558 (21.12.2020); W. Knight, *Prepare for Artificial Intelligence to Produce Less Wizardry*, Wired 7 November 2020, https://www.wired.com/story/prepare-artificial-intelligence-produce-less-wizardry/ (online access: 21.12.2020).

4 M.J. Casey, P. Vigna, *The Truth Machine: The Blockchain and the Future of Everything*, New York 2018.

data into the register on all computers belonging to the network. Each of them records the data independently but in a coordinated way, exactly the same as the other computers. The algorithm then cryptographically seals the new block, making it impossible to change the information it contains.

The technology was originally used to create cryptocurrencies such as bitcoin, but the potential benefits of using it to maintain protected and reliable data records were quickly recognised. A blockchain can be used to confirm the identity of individuals and organisations, confirm the reliability of data obtained from various sources, confirm ownership of resources and for decentralised data processing. Currently, blockchain solutions are being tested primarily in the financial sector, *e.g.* for balancing payments between banks, bypassing intermediaries and in near real time.[5]

Datafication and platformisation

In the 1990s, data began to be mass-produced by Internet users, which was used by technology companies to build new business models. They were based on the production of new kinds of goods and services: fully digitised (so-called digital information goods, such as ebooks or digital music, games or films) or combining material and digital elements (so-called smart products). Datafied goods and services were becoming a rich source of data about their users. Advanced, self-learning algorithms, cloud computing and the Internet of Things are making it possible to collect, process and analyse these abundant data faster and cheaper, and these data are becoming one of the primary factors of production. The information obtained from them influences the way organisations operate, with ever greater and more precise knowledge of their customers and partners. This process of deriving value – economic, social or political – from abundant data sets through sophisticated analytical tools, most often using intelligent algorithms, can be referred to as datafication.[6]

We are dealing here with a self-perpetuating mechanism: the more data, the better calibrated and "smarter" algorithms that can learn from growing data sets. Implementing AI-based solutions serves two primary purposes: analysing large data sets to make predictions, which in turn supports decision-making processes; and automating processes and tasks.[7] There are new and increasingly personalised, *i.e.* tailored to users' expectations and needs, products (goods and services), as well as new business models based on the expanding networks connecting people, systems, machines and organisations. Platforms use data to precisely connect market parties, and build their competitive advantage on the skilful use of network effects.

5 *Ibid.*

6 V. Mayer-Schonberger, K. Cukier, *Big Data: A Revolution That Will Transform How We Live, Work and Think*, New York 2013.

7 A. Agrawal, J. Gans, A. Goldfarb, *Prediction Machines: The Simple Economics of Artificial Intelligence*, Boston 2018.

Under the influence of datafication, the internal operating models of organisations are also changing towards those that prioritise the use of data and intelligent algorithms ("data-first, AI-first") in management, procedural and production processes.

Production processes (we mean in this context both the production of goods, but also the provision of services by economic entities, public institutions or non-governmental organisations) are subject to increasingly far-reaching automation in all areas where people have so far been engaged in performing tasks which were routine and repetitive, and therefore inherently translatable into logical procedures, in other words – algorithms. It is worth emphasising that this applies not only to processes requiring manual labour, but also to those that were traditionally performed by white-collar workers. The so-called Robotic Process Automation (RPA) includes various types of bots and other computer programs. The simplest bots have to be programmed top-down to perform specific tasks. Self-learning bots, based on machine learning algorithms, use databases of historical and current examples to train sequences of tasks performed by human employees. Even more advanced cognitive bots use machine learning and deep learning algorithms to capture correlations and regularities from structured and unstructured data, autonomously finding task sequences amenable to automation. Bots are capable of performing routine and generally tedious tasks on their own for human employees: reading and sending emails and analysing them for relevant information; logging into and reading databases; filling out forms; collecting statistics from social media and scouring the web for data.[8] At a more general level, bots are able to extract data (*e.g.* from PDF documents), integrate data from different sources (*e.g.* personal data and data from public registers), convert data into different formats required by different institutions and integrate them into available databases.

The implementation of technology entails operational and organisational changes: the internal structure of the organisation is being transformed in favour of a flatter (especially given the middle management level is being depleted) and more flexible one (project teams with variable staff composition, increasingly internationalised, instead of rigid divisions into departments or sections). Organisations – not only companies in the technology sector, which is the core of the digital economy, but also in sectors considered traditional, from industry through services to agriculture, but also to NGOs – are being platformised, becoming elements of broad production ecosystems. The spread of digital technologies is translating itself into organisational and process changes, becoming the basis for digital transformation. Countless, diverse, dispersed and uneven digital transformation processes are changing the functioning of companies, markets, consumers, employees, the state, by building a new kind of economy, based on the interrelated processes of datafication, intelligent automation, platformisation and personalisation – the digital economy.

Under the influence of new technologies, the state and its institutions composing the public administration, its structure and the model of its operation, especially the way of

8 Deloitte, *The new machinery of government. Robotic Process Automation in the Public Sector*, 2017, https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/public-sector/deloitte-nl-Robotic-process-automation-in-the-public-sector.pdf (online access: 21.12.2020).

satisfying the needs of citizens, are also changing. It is worth remembering that the basic function of the state administration since the beginning of time has been to collect, store, analyse and use data on phenomena and processes occurring on the territory of the state and its inhabitants. The state is a repository of enormous datasets. However, a large part of them still remains undigitised and therefore cannot be used in the datafication process. This is one of the reasons why the process of the digital transformation of public institutions differs significantly from the analogous process taking place in companies and other private sector institutions. Moreover, when starting to implement new technologies, decision-makers must take into account the interests of many social groups and political parties, while focusing on the broader public interest (which, of course, may be defined differently depending on the world-view). Reduction of labour costs and greater efficiency of internal processes or productivity are not the only measures of success; preventing the discrimination or exclusion of particular groups of citizens is equally important.

Decision-makers in public institutions are also less inclined to bear the risks inherent in the implementation of large infrastructure projects, especially since the duration of a project is often limited by time of successive elections.[9] Public institutions are also usually much more conservative, which is expressed, *inter alia*, in their reluctance to introduce new systems. As a result, they often struggle with the so-called technological organisational legacy, resulting from the burden of outdated IT infrastructure. Another barrier to the implementation of new digital technologies is the siloed nature of data available to the public sector: data are collected in incompatible formats, still often on paper, and according to incompatible methodologies. Meanwhile, artificial intelligence technologies in particular need adequate, abundant and high-quality data on which algorithms can be trained.[10] The scale of implementation projects is also an obvious challenge. It is worth remembering in the context of the examples of digital transformation in Estonia or Singapore, which are often held up as a model: the scale and complexity of changes introduced in a country with 1.3 million citizens or even 5.7 million citizens differs from the scale and complexity of changes in a country inhabited by tens of millions of people.

ICT deployment and e-government development

In the first decades of computerisation, public administration in highly developed countries did not lag behind the private sector: it was public institutions that bought the first PCs, perceiving digitisation as an opportunity to improve analytical processes, and later introduced local networks (LANs) hoping that the transition from paper to electronic

9 K. Desouza, T. Makasi *et al.*, *Chatbot-mediated public service delivery: a public service value-based framework*, “First Monday” 2020, 25(12).

10 J. Tobin, *Predictive and Decision-making Algorithms in Public Policy*, House of Lords Library, 3 February 2020, https://lordslibrary.parliament.uk/research-briefings/lln-2020–0045/ (online access: 20.12.2020).

document circulation would facilitate communication. However, the lack of competent staff with sufficiently advanced IT skills was a growing problem; private organisations generally offered much higher wages. As a result, outsourcing IT services, combined with the implementation of IT systems purchased from external suppliers, has become the norm.[11] During the 1990s, the inherent conservatism of bureaucratic organisations and their reluctance to depart from once implemented systems and formats, or even to update them, became more and more evident. This phenomenon, sometimes referred to as the institutional legacy burden, meant that individual institutions, and even departments or divisions within their internal structure, were locked in specific silos: their IT systems did not cooperate with each other, and incompatible data formats did not allow for the exchange of information and knowledge.[12] The negative consequences manifested themselves, *inter alia*, in the lower quality of the decision-making process, difficulties in coordinating the administrative apparatus and a lower quality of public services (*e.g.* in terms of the time and effort a citizen had to devote to verifying his/her identity with various institutions and harmonising and completing his/her data).

Governments and public administrations have been less conservative in their use of the Internet, which soon began to be used as a new channel of contact with citizens, firstly to present information and then to allow two-way interaction between the public and public institutions. Over time, selected public services have also been delivered *via* the Internet. In public and academic discourse, the term "e-government" emerged, understood as "the use of information and communication technologies to provide government services to citizens and businesses more effectively and efficiently."[13] In other words, the specificity of e-government lies in the delivery of e-services with varying degrees of sophistication and involving citizens to varying degrees. At its most basic edition, an e-service amounts to posting information on a procedure or required documents on the institution's website. A slightly more advanced service allows one to download the necessary forms and then to start the procedure remotely (after confirming the identity of the applicant; its finalisation, however, takes place in the office in direct contact). E-service reaches the transactional level, when it is completely carried out remotely. It is increasingly common for citizens to have access to services tailored to their specific needs (personalised): forms are *e.g.* pre-filled with data already held by the public administration and a virtual assistant suggests what steps should be taken to finalise the procedure.

The development of digital public services in the European Union is measured by the DESI (Digital Economy and Society Index). It is worth noting that despite the selective introduction of transactional and partially personalised e-services such as electronic tax returns, Poland is on the last positions in the ranking.

11 J.W. Cortada, *The Digital Hand*, Vol. 3, *How Computers Changed the Work of American Public Sector Industries*, New York 2007.

12 F. Bannister, *Dismantling the Silos: Extracting New Value from IT Investments in Public Administration*, "Information Systems Journal" 2008, 11(1).

13 e-Government Knowledgebase, https://publicadministration.un.org/egovkb/en-us/about/unegovdd-framework (online access: 20.12.2020).

Table 1. Digital public services indicators in Poland in comparison with the EU

	POLAND						EU
	DESI 2018		DESI 2019		DESI 2020		DESI 2020
	value	place	value	place	value	place	value
E-Government users (% Internet users needing to submit forms)	45 (2017)	23	49 (2018)	25	54 (2019)	21	67 (2019)
Pre-filled forms	48 (2017)	17	54 (2018)	17	58 (2019)	16	59 (2019)
Online service completion	81 (2017)	21	84 (2018)	20	87 (2019)	20	90 (2019)
Digital public services for businesses	70 (2017)	25	75 (2018)	24	75 (2019)	25	88 (2019)
Open data	N/A		N/A		78 (2019)	7	66 (2019)

Source: compiled on the basis of Digital Economy and Society Index (DESI). The maximum value of each index is 100

It is worth noting that a more dynamic development of e-services is conditioned by the implementation of cloud solutions by public administration as a technological platform for their delivery. They make it possible to scale services: to involve more institutions in the cooperation and to extend the distribution to more recipients. The use of cloud solutions also avoids the main barriers that stand in the way of digital transformation in public administration, including the costs of overcoming technological legacies and the costly cyclical updating of hardware (computers and servers). A leader in this field is the UK, which introduced a Government Cloud First policy in 2013 in the development of public services; also in the United States, public administration routinely uses Microsoft Cloud for Government.[14]

The use of cloud services generally means that their basic infrastructure (powerful servers and data centres) is located outside the territory of a given country and is controlled by large technology companies, the vast majority of which are American. An increasing number of countries see this as a threat to sovereignty as traditionally understood, whereby the government exercises control and custody over the affairs of its citizens. A new dimension of sovereignty is emerging – data sovereignty, based on the idea that data should be processed and stored in the same country where they were generated. There is also a new European initiative to build a data ecosystem integrating distributed cloud services provided by many individual providers, called Gaia-X.[15]

14 Government Digital Service, Government Cloud First policy, 3 February 2017, https://www.gov.uk/guidance/government-cloud-first-policy (online access: 20.12.2020).

15 Gaia-X, https://gaia-x.eu/ (online access: 20.12.2020).

Implementation of intensifying technologies in public administration

Estonia is the most frequently cited case study of digitisation processes taking place in public administration. In this small country almost all public services (99%) are available online. In 2001, the Estonian government launched the first version of the X-road platform, which provides all public institutions, companies and citizens with the ability to integrate databases and exchange information. X-road connects more than 1,300 information systems and enables the delivery of more than 2,700 services. Copies of data are kept in the cloud outside the country's borders, better protecting them from potential cyber attack. Citizens can access a wide variety of public services (such as e-Voting, e-Tax Board, e-Business, e-Banking, e-Ticket and e-School) through a digital identity card, with the digital identity verified through a special code and yet another code to confirm transactions (*e.g.* entering into a contract). Estonia is also blazing new trails in the use of blockchain technology to secure data in the health system, court registers, mortgage registers, business, inheritance and the judiciary. It is estimated that Estonia saves 1,400 years of human labour and 2% of its GDP annually by implementing digital solutions.[16]

Few countries achieve a similar level of sophistication. The prevailing view among digitisation researchers is that currently public administrations implement new technologies reluctantly and in a reactive manner, responding to specific challenges or problems and partly to passing fashions.[17] Technologies serve to improve basic functioning, but their implementation rarely leads to operational or organisational changes. This is also reflected in the subject literature: one of the meta-analyses showed that of a selection of 1,438 articles on the implementation of artificial intelligence-based solutions published between 2000 and 2019, only 59 dealt with implementations in the public sector.[18] Discussions of the anticipated benefits of the potential implementation of particular technologies, derived by analogy to the benefits enjoyed by private sector organisations, dominate, while there are few empirically anchored evaluative analyses based on actual implementations.

The narrative on the implementation of Internet of Things solutions in public administration is a good illustration of this state of affairs. The deployment of sensors in public spaces makes it possible to collect data to optimise transport management (*e.g.* traffic management thanks to sensors placed at road level or drones), municipal management (waste management thanks to sensors indicating how full the containers are), but also the way healthcare or public administration functions. Smaller countries – such as Singapore – are also testing the more advanced capabilities offered by the Internet of Things, such as the creation of digital replicas (digital

16 PwC, *Estonia – the Digital Republic Secured by Blockchain*, 2019, https://www.pwc.com/gx/en/services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf (online access: 21.12.2020).

17 O. Ali, A. Shrestha *et al.*, *Cloud computing technology adoption: an evaluation of key factors in local governments*, "Information Technology & People" 2021, 34(2).

18 G. Misuraca, C. van Noordt, *AI Watch – Artificial Intelligence in public services: Overview of the use and impact of AI in public services in the EU*, Luxembourg 2020, p. 11.

twins) of the entire urban infrastructure and its surroundings, enabling a rapid response to threats and crises. However, all these solutions are still in the testing or implementation phase, or have the character of limited piloting.[19] The authors of the articles thus dwell on the potential opportunities offered by this technology, from the ability to manage infrastructure systems in real time to the personalisation of services for the population based on data collected in real time.

In the remainder of this chapter, we will look in more detail at the implementation of two technologies considered to be flagships for digital transformation: artificial intelligence and blockchain.

Artificial intelligence

In December 2018, the European Commission established AI Watch, a kind of think tank (knowledge service) dedicated to monitoring the development, deployment and impact of artificial intelligence in Europe. In 2020, a team of AI Watch analysts presented the results of a mapping exercise identifying 230 public sector artificial intelligence deployments in European countries.[20] The largest number of applications was identified in the area of General Public Services (76/230), Economic Affairs (40/230) and Healthcare (41/230). The majority of deployed AI applications support the decision-making process (38%, 87 out of 230 cases); one in five applications supports law enforcement (*e.g.* to detect violations through social media monitoring) or supports internal management systems (*e.g.* analyses in HR departments). Only in 12 cases was artificial intelligence used in systems for the delivery of social benefits (*e.g.* in Latvia, the verification of benefit claims was automated).[21] The types of applications of artificial intelligence in the mapped projects are shown in Figure 1.

Beyond its purely descriptive value, the analysis has shown that the vast majority of applications are incremental and technical in nature, and do not involve a transformational change in the functioning of public administration. However, the most important conclusion reached by the authors of the report was as follows: the promising successes of small-scale pilots and successful experiments do not guarantee translation into stable and useful implementations in a given institution, let alone in a wider public administration.[22]

Barriers and challenges in the process of introducing artificial intelligence are illustrated by the experience of implementing the most frequently used AI functionalities – chatbots and virtual assistants. Chatbots are able to answer frequently asked questions in natural language (*i.e.* the language that people use in everyday conversations). More advanced chatbots are able to guide the user through the administrative procedure and provide personalised problem-solving support.[23] According to the Estonian vision of creating digital

19 K. Jonsson, O. Velsberg, U.H. Westergren, *Exploring smartness in public sector innovation – creating smart public services with the Internet of Things*, "European Journal of Information Systems" 2020, 29 (4).

20 G. Misuraca, C. van Noordt, *AI…*, *op. cit.*, p. 13

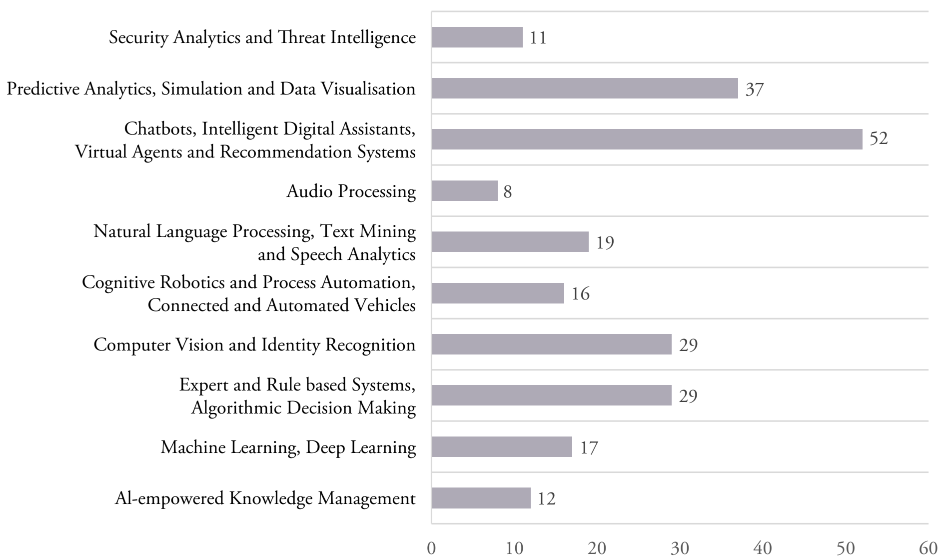
21 *Ibid.*, pp. 24–26.

22 *Ibid.*

23 K. Desouza, T. Makasi *et al.*, *Chatbot-mediated public service delivery: a public service value-based framework*, "First Monday" 2020, 25(12).

services for citizens, announced in 2019, the chatbot will be the single contact channel for an interoperable and distributed (for security reasons) network of artificial intelligence-based applications, called #KrattAI.[24] The Estonian government intends to limit investment in interfaces of other types, such as websites. Services will be further personalised based on data about the individual user; in other words, the chatbot will not repeat vague phrases containing generic information, but will tailor its answer according to, for example, the age and gender, or even the interests of the questioner, based on a package of information gathered from a variety of sources, including social media. Users will be able to use it in order to authorise various actions, such as submitting applications, making payments or changing their data. The advantages of such an integrated solution for the citizen are illustrated by the Estonian government with the story of a citizen who, while having her morning coffee, encouraged by a virtual assistant, renews her passport by authorising the transaction with her biometric data. The interaction with the bureaucracy is minimal, anticipatory (the absence of a valid passport would prevent the citizen from using already purchased tickets; it is also an example of the integration of data from public and private sources, in this case from an airline operator) and unobtrusive. "Our digital government is so pleasant and easy to use" is the thought that is supposed to appear in the citizen's mind after the interaction with the administration is over.[25]

Figure 1. Types of AI applications in public administration in Europe



Source: G. Misuraca, C. van Noordt, *AI Watch – Artificial Intelligence in public services: Overview of the use and impact of AI in public services in the EU*, Luksemburg 2020, p. 23

24 *Factsheet: AI – "kratt" strategy*, e-estonia, https://e-estonia.com/wp-content/uploads/2020-april-facts-ai-strategy.pdf (online access: 21.12.2020).

25 *#KrattAI: the next stage of digital public services in #eEstonia*, kratid.ee 24 February 2020, https://www.kratid.ee/visionpaper (online access: 21.12.2020).

Therefore, the implementation of chatbots brings the promise of personalisation and intelligent automation that is comfortable from the perspective of the user of public services. From the perspective of the administration, there is hope for the release of officials from tediously repetitive and predictable interactions with customers to solve specific and non-obvious problems that require the use of contextual knowledge, which artificial intelligence will not be able to cope with for a long time, and on the other hand – an increase in service efficiency as a result of the automation of routine processes. This could bring about the structural changes reminiscent of those occurring in companies: flattening the management structure and opening up to partnerships with other institutions operating on a similar basis.

A 2019 analysis of the functioning of chatbots used in public institutions in Latvia and in municipal offices in Bonn and Vienna, however, showed that this technology has so far shown little transformational potential. For example, WienBot, installed in 2017, although it answers a whole range of questions about specific public services, it does not enable the citizen to deal with the matter directly. Using Garner's typology cited above, they allow for the introduction of a level of information and to some extent interaction, but not transaction. In each of the three cases analysed, chatbots provided information but did not enable matters to be dealt with, they did not provide integrated information and only in the case of Latvia were the researchers able to observe organisational changes involving the redeployment of officials to other, more complex tasks.

> If there is no sufficient amount of data sharing between public organizations, citizens will still be required to provide the same kind of information multiple times. Filling in the same kind of information on a government form is – with or without a Chatbot – a tedious and annoying task. Just having a Chatbot is not going to make this procedure any more satisfactory. If the public sector truly wants to gain maximum benefits from emerging technologies, such as Chatbots, it will require massive public reform, a change in administrative culture and a strong reflection on the current organizational practices.[26]

In other words, introducing technological innovations without changing the rules of the entire administration is reminiscent of the biblical pouring of new wine into old wineskins.[27] In the case of the aforementioned #AIKratt, it will be necessary not only to solve the technological problem of current and accurate voice recognition in Estonian, but also to make the operation of the applications created by different public institutions more consistent, and to coordinate the exchange of data on citizens. Building citizens' trust in the "black box" of technology is also a key challenge. Experiments conducted in Japan on the use of chatbots showed that citizens were more willing to talk to chatbots

26 G. Misuraca, C. van Noordt, *New Wine in Old Bottles: Chatbots in Government – Exploring the Transformative Impact of Chatbots in Public Service Delivery* [in:] *Electronic Participation*, eds. N. Edelmann, O. Glassey *et al.*, San Benedetto del Tronto 2019.

27 *Ibid.*

about waste management than about custody issues.[28] These results are interesting in that Japanese society shows an extremely high level of positive attitudes in the area of modern technology implementation.[29] Successful implementation of the technology must therefore be based on a foundation of citizen trust in government, supported by an open information policy on how chatbots work and how to use and secure the data they collect.

Blockchain

Blockchain, which in the simplest terms is a distributed, cryptographically secured and transparently controlled database, may find numerous applications in the practice of public administration. First of all, it can support notary functions, *i.e.* it can be used to authenticate all kinds of documents, from birth and death certificates through passports and visas to mortgage registers. It can also facilitate the process of sharing data between various institutions, locked in technological silos – the registers created on its basis are, in principle, transparent and verifiable by all entities involved in its maintenance. Finally, through so-called smart contracts, blockchain enables process automation. Theoretically, blockchain can be used to organise elections: each vote cast can be securely encrypted and the whole procedure transparent to all participants.[30] The implementation of blockchain solutions may increase the security of interactions and transactions between the citizen and administration, creating a foundation for citizens' trust in digital public services.[31]

Despite this promising potential, examples of the practical application of this technology in public administration are few; in 2019, experts from the Joint Research Centre (JRC) identified only a dozen of them across Europe. In Estonia it is the most widely used, with blockchain solutions called Keyless Signature Infrastructure (KSI) to ensure the security of public databases.[32] The Exonum system in Georgia is used to provide additional security for mortgage registers archives; in Malta, blockchains are used to validate academic credentials (the technology is used in Japan for the same purpose[33]); Sweden's Chromaway is used to secure and accelerate real estate transactions. In the

28 N. Aoki, *An experimental study of public trust in AI chatbots in the public sector*, "Government Information Quarterly" 2020, 37(4).

29 K. Devlin, B. Stokes, *Despite Rising Economic Confidence, Japanese See Best Days Behind Them and Say Children Face a Blank Future*, Pew Research Center, 12 November 2018, https://www.pewresearch.org/global/2018/11/12/sentiment-about-the-state-of-the-economy-trade-and-prospects-for-the-future/ (online access: 20.12.2020).

30 A. Dhillon, G. Kotsialou *et al.*, *Long Read: How blockchain can make electronic voting more secure*, LSE USAPP – American Politics and Policy blog 25 September 2020, https://blogs.lse.ac.uk/usappblog/2020/09/25/long-read-how-blockchain-can-make-electronic-voting-more-secure/ (online access: 20.12.2020).

31 B. Franczyk, M. Hernes *et al.*, *Digital Transformation of Public Administration Through Blockchain Technology* [in:] *Towards Industry 4.0 – Current Challenges in Information Systems*, eds. M. Hernes, D. Jelonek, A. Rot, 2020.

32 S. Cheng, M. Daub *et al.*, *Using blockchain to improve data management in the public sector*, 28 February 2017, https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/using-blockchain-to-improve-data-management-in-the-public-sector (online access: 20.12.2020).

33 J. Clavin, S. Duan *et al.*, *Blockchains for Government: Use Cases and Challenges*, "Digital Government: Research and Practice" 2020, 1(3).

Netherlands, a blockchain-based pension payment system is being tested at a central level, and in the Dutch city of Groningen, a system for redistributing benefits to low-earning employees is under tests.[34] In 2017, the UK also ran a pilot programme to use blockchain in its benefits distribution system.[35] In Poland, blockchain is being used, among others, in the creation of a shared services centre in Toruń to accelerate and streamline electronic documents workflow.[36]

The conclusions drawn from the analysis of existing applications are not optimistic. In most cases, there is a critical gap between the capabilities of the technology at its current stage of development and the scale and complexity of the administrative systems in which it is attempted to be deployed. Projects with a limited number of partner institutions, centralised management and an external partner with relevant competencies to deal with technological issues have achieved a high level of maturity. JRC analysts concluded that blockchain implementations, so far, are neither transformative nor disruptive:

> We have not observed the creation of new business models, the emergence of a new generation of services nor direct disintermediation of any the public institutions involved in the provision of governmental functions.[37]

Legal regulations and the lack of interoperability standards between institutions also stand in the way. The most likely scenario is the use of blockchain to secure so-called data-at-rest, archived but not used on an ongoing basis (personal records, records of transactions or contracts). On the other hand, data in constant use will be secured and authorised by means of simpler and cheaper methods, *e.g.* identity verification by means of a trusted profile confirmed by online banking login data.[38]

Datafication and platformisation of public administration

A review of the use of new technologies in digital government demonstrates that digital transformation – in its technological, operational and organisational aspects – is a much more complex and staggered challenge than for private sector organisations.

34 G. Misuraca, C. van Noordt, *op. cit.*

35 L. Kello, I. Martinovic, I. Sluganovic, *Working Paper Series – No. 7: Blockchains for Governmental Services: Design Principles, Applications, and Case Studies*, Centre for Technology & Global Affairs, December 2017, https://www.ctga.ox.ac.uk/sites/default/files/ctga/documents/media/wp7_martinovickellosluganovic.pdf (online access: 20.12.2020).

36 R. Karaszewski, J. Modrzyńska, P. Modrzyński, *The Use of Blockchain Technology in Public Sector Entities Management: An Example of Security and Energy Efficiency in Cloud Computing Data Processing*, "Energies" 2021, 14(7).

37 J. Berryhill, T. Bourgery, A. Hanson, *Blockchains Unchained: Blockchain Technology and its Use in the Public Sector*, "OECD Working Papers on Public Governance" 2018, 28, p. 26.

38 C. Crittenden, M. Sistla, *Blockchain, Digital Identity and Health Records: Considerations for Vulnerable Populations in California*, Citris Policy Lab, 2020, https://citrispolicylab.org/wp-content/uploads/2020/10/2020-Blockchain-ID-homeless-final.pdf (online access: 21.12.2020).

Technological implementations must be accompanied by a precise strategy for their use in terms of existing and planned organisational processes and the implementation of organisational change. Process design consists in integrating and managing processes as a complex system of interdependent activities. Process integration takes place in many areas of the activities of public institutions, from document circulation within offices, through management processes, to the life cycle of the very services provided to citizens, from production, through the supply chain and the product life cycle. As processes become more integrated and standardised, they begin to form a unified system where data are shared, processed and consistent across the management layers of the institution and in the way services are delivered to citizens. Organisational change comes from a change in the structure of the organisation, which is becoming more horizontal and open, and a change in the way human labour is used. Developing digital competences and skills among staff at all levels of the organisation and fostering a new organisational culture that moves away from hierarchy towards project-based working becomes crucial.

If these changes are not taking place, we can talk about selective and limited digitisation processes based on pilot implementations of technologies, about epidermal digitisation rather than digital transformation. However, it is necessary to analyse the perspectives for the digital transformation of public administration. First of all, however, as in the case of companies, the implementation of new technologies and organisational changes related thereto may be accelerated as a result of a crisis, requiring non-standard solutions. Such a role was certainly played by the coronavirus pandemic, which forced a shift to remote working and the electronification of a whole range of public services. COVID-19 has accelerated digitisation processes, highlighting the benefits of faster analysis, more in-depth and precise knowledge of real-world phenomena and processes, and better prediction in a world full of unpredictable crises. Secondly, digital transformation efforts are guided by a specific normative objective of reforming public administration and, more broadly, the entire state management apparatus. The digital transformation is expected to result in the emergence of a digital government, whose properties were described by OECD experts working on the Digital Government Policy Framework as follows:

- digital by design, *i.e.* it has a purposeful digital architecture;
- data-driven public sector. Data are treated as a strategic asset; used to plan, implement and evaluate public policies;[39]
- government as a platform;
- in principle, it makes public data available and ensures transparency of policy processes (within the limits set by law and public and state interest);
- user-driven administration;
- proactiveness.

39 Organisation for Economic Co-operation and Development, *Strengthening digital government*, OECD Going Digital Policy Note, OECD 2019, www.oecd.org/goingdigital/strengthening-digital-government.pdf (online access: 21.12.2020).

Table 2. Stages of digital transformation

	Stages of digital transformation		
Change path	**Digitisation** of public administration (technology in administration)	**E-government**	**Digital government**
Overarching goal of technology implementation	To improve cross government activities and information management.	The use by governments of digital technologies, particularly the Internet, to achieve efficiency and productivity.	Datafication and platformisation of the public sector for the public interest, based on the reintegration of hitherto fragmented government functions and the holistic satisfaction of citizen needs.*
Specific objectives	Focus on efficiency (cost savings) and productivity.	Focus on efficiency and productivity in delivering tailored public services to individuals.	Emphasis on governance focused on openness, transparency, citizen engagement and trust in government, as well as efficiency and productivity.
The role of the citizen	Citizens are passive recipients of top-down designed services.	Citizens gain influence over the quality and design of services.	Citizens have a significant influence on the design of services, their quality and how they are delivered.

* S. Bastow, P. Dunleavy *et al.*, *New Public Management Is Dead – Long Live Digital-Era Governance*, "Journal of Public Administration Research and Theory" 2005, 16(3); R. Davies, *eGovernment. Using technology to improve public services and democratic participation*, European Parliamentary Research Service, 2015, https://www.europarl.europa.eu/RegData/etudes/IDAN/2015/565890/EPRS_IDA(2015)565890_EN.pdf (online access: 21.12.2020).

Source: modified and expanded table from the OECD report *Digital Government Strategies for Transforming Public Services in the Welfare Area*, 2016, https://www.oecd.org/gov/digital-government/Digital-Government-Strategies-Welfare-Service.pdf (online access: 21.12.2020)

In a nutshell, it can be assumed that digital government is based on the principles of datafication, *i.e.* the ability to derive value from data, and platformisation, resulting from and at the same time strengthening the possibility of datafication by changing the internal organisational structure and the relationship with the environment.

In the case of organisations of all kinds, the datafication translates into the ability to tailor the product/offer to the user's needs (thanks to data collected on an ongoing basis about the user and the way the product is used); in the case of public administration, this means the personalisation of public services. The idea of a state acting like Amazon, suggested by Deloitte in 2017, implies that the state will aim to provide citizens with the same quality and comfort as platform companies. This requires the creation of a holistic digital experience that is unlimited as to time, place and device; the introduction of digital identification mechanisms through which citizens are able to log in to any service; and the development of data-sharing mechanisms.

The second main consequence of datafication is the possibility to optimise internal decision-making processes and to reorganise organisational processes, *e.g.* ways of involving human labour. One consequence of datafication is the increasing automation of tasks previously handled by employees of public institutions.[40] In Romania, the Ministry of Labour, Family and Social Insurance used RPA to distribute benefits to self-employed workers; the program, implemented within a month, allowed 96% of 285,000 benefit claims to be automated, with the whole process taking 36 seconds instead of the 20 minutes required by a human worker.[41] The use of algorithms allows for the introduction of algorithmic management, realising the ideal of impersonal, efficient, effective and theoretically disinterested administration, as conceived by the German sociologist Max Weber. However, there are multiple risks involved: algorithms may operate on the basis of fundamentally discriminatory rules, as was the case with the system for categorising the unemployed used in Poland. Machine-learning algorithms may be trained on poorly calibrated or incomplete datasets, and thus become a tool for structural discrimination.[42] Algorithmic management therefore requires the introduction of additional constraints and controls on the part of officials and, above all, transparency as to how the scheme is constructed, especially if it is to be operated by artificial intelligence.

Equally a consequence of the implementation within public administration of new technologies is the ensuing structural change – the transformation of hierarchical government-administrative structure into a horizontal platform structure. Individual institutions and public offices are prioritising the use of data by introducing common interoperability standards. Government works on a network of common APIs (application programming interfaces), open standards and databases, leveraging economies of scale in building public services.[43] A pioneering approach to the concept of government in the context of using new technologies was proposed in 2011 by Tim O'Reilly in his article *Government as a Platform*. O'Reilly noted that government is often treated like a vending machine: citizens put money into it (taxes) and in return they get services. Government, on the other hand, should be seen as the manager of a bazaar – a vast ecosystem of interconnected private organisations and public institutions that provide

40 P. Fettke, M. Hamberg, C. Houy, *Robotic Process Automation in Public Administrations* [in:] *Digitalisierung von Staat und Verwaltung*, eds. S. Halsbenning, M. Räckers *et al.*, Bonn 2019, pp. 62–74.

41 E. Knutt, *Take out the tedious: robotic automation in government*, Global Government Forum, 14 October 2020, https://www.globalgovernmentforum.com/take-out-the-tedious-robotic-automation-in-government/ (online access: 20.12.2020).

42 K. Sztandar-Sztanderska, M. Kotnarowski, M. Zieleńska, *Czy algorytmy wprowadzają w błąd? Metaanaliza algorytmu profilowania bezrobotnych stosowanego w Polsce*, "Studia Socjologiczne" 2021, 1 (240), pp. 89–115.

43 R. Pope, *A working definition of Government as a Platform*, digital HKS – Medium, 22 July 2019, https://medium.com/digitalhks/a-working-definition-of-government-as-a-platform-1fa6ff2f8e8d (online access: 20.12.2020).

services to users. The latter can freely choose between services and their providers. This approach means leaving to the government the function of providing the institutional architecture, the core applications and coordinating their work.

> In the technology world, the equivalent of a thriving bazaar is a successful platform. If you look at the history of the computer industry, the innovations that define each era are frameworks that enabled a whole ecosystem of participation from companies large and small. How does government become an open platform that allows people inside and outside government to innovate? How do you design a system in which all of the outcomes aren't specified beforehand, but instead evolve through interactions between government and its citizens, as a service provider enabling its user community?[44]

Table 3. Impacts of datafication and platformisation of government/public administration

Manifestations of datafication and platformisation	Benefits and opportunities	Threats and challenges
Administration gains access to citizens' behavioural data through the ability to integrate previously dispersed public and private data sources.	Administration has more precise knowledge about actions, expectations and needs of citizens. Administration better diagnoses social, economic and political problems and challenges. Personalisation of public services: services are precisely, flexibly and anticipatively adapted to the expectations and needs of citizens.	Potential for greater control over citizens' activities: *e.g.* the government is able to actively discourage citizens from engaging in activities that are deemed incompatible with the government's desired social, economic and political order. The risk of a datafied, maximally effective state surveillance over citizens. The risk of power asymmetry: an authority knows more about citizens than citizens know about the authority. The risk of increasing the exclusion of citizens who are unwilling or unable to use digital systems and devices.
Administration and government are using communication tools more and more effectively based on available data on citizens.	Implementation of digital technologies enables better and faster communication as well as information and knowledge transfer between citizens and the administration. Change in the relationship between citizens and government towards greater democratisation, citizen participation and influence on governance.	Difficulties are emerging in setting coherent policy goals in a context of growing complexity and the need to take into account the interests, expectations and needs of many social groups openly articulating their needs. The dangers of exclusion in accessing information are gaining strength.

44 D. Lathrop, L. Ruma, *Open Government: Collaboration, Transparency, and Participation in Practice*, Sebastopol 2010.

Manifestations of datafication and platformisation	Benefits and opportunities	Threats and challenges
Government routinely uses digital technologies in decision-making.	Strategic rationalisation of public policies thanks to the growing analytical and predictive potential provided by AI technologies. Faster response to crises and the ability to anticipate them thanks to predictive potential. Algorithmic management ensures faster and more efficient decision-making and delivery of public services.	Algorithmic governance may rely on algorithms programmed to intentionally or unintentionally discriminate against specific social groups or working on incomplete, skewed in certain respects or poorly calibrated databases. Technological dataism/ solutionism: a belief in the priority of data in decision-making combined with an increasing reduction of human decision-making input.*
Government uses digital technologies to automate tasks and internal processes.	Automation improves efficiency and reduces the cost of delivering public services. Tasks automation frees clerical staff from tedious and repetitive tasks, allowing them to focus more on creative or customer service tasks.	The automation of some tasks may lead to technological unemployment in public administration.
Structural changes in public administration lead to a kind of unification of the structure and operation of institutions, offices and teams, which facilitates cooperation among them and cooperation with private entities and citizens, in various configurations.	The government opens up to private-public partnerships, which increases the possibilities to deliver and personalise public services. Greater flexibility, ability to make structural changes more quickly.**	Structural fragmentation/ decentralisation of the public service delivery system occurs, making coordination difficult. Risk of dependence on external public service providers.
The government adopts a policy of sharing data with other entities.	Citizens gain a sense of, and tools for, the control of actions of the government. Private organisations and citizens themselves can use open data to create new ways of delivering services and new public services.	Open data can be used for commercial purposes, disregarding social interests. Open data may be used to the detriment of state interests (*e.g.* by hackers, the intelligence services of other countries).

* J.S. Pedersen, A. Wilkinson, *Big Data: Promise, Application and Pitfalls*, Cheltenham 2019.
** Fujitsu, *Government as a Platform*, 2015, https://www.fujitsu.com/uk/Images/government-as-a-platform.pdf (online access: 21.12.2020).

Source: own study

The implementation of new technologies enabling platformisation and datafication carries the potential for a comprehensive reform of the way public services are delivered. An example of a consistent restructuring of the hierarchical structure of government and administration is provided – in addition to Estonia – by the UK. The Government-as-a-Platform (GaaP) website outlines a vision of

> a common core infrastructure of shared digital systems, technology and processes on which it's easy to build brilliant, user-centric government services.

This infrastructure is made up of generic functionalities, the building blocks that allow new services to be created, such as for confirming identity (Verify), sending messages (Notify), making payments (Pay) and cross-team service creation (Design system).[45] Figures for 2020 show that GOV.UK Notify sent 1.6 million messages, while GOV.UK Pay accepted 7.1 million payments, which went to 160 public sector organisations. As a result of such wide-ranging organisational changes, public administration is taking shape as a digital platform ecosystem supporting the creation of new, cheaper and more useful services for citizens. The relationship between the state and the citizen is also changing towards one that is focused on collectively building solutions.

Summary

For over a decade, intensifying technologies such as cloud solutions, artificial intelligence and blockchain have been changing the paradigm of how organisations of all types operate. Operational and business models that prioritise data and the technologies for their collection, processing and use allow one to build competitive advantages derived from the ability to personalise product, optimise management and respond more quickly to change. This applies primarily to technology companies, especially those that are also platforms, but more and more often also to companies operating in traditional sectors. The state and its institutions are also increasingly bold in their approach to digital transformation, aiming to improve the accessibility and quality of public services for citizens. At the same time, the government can manage public affairs more efficiently by deriving value from the vast data resources at its disposal.

The digital transformation can result in a shift from a paradigm of government/public administration previously conceived as a hierarchical organisation, focused on achieving top-down governance objectives, to a paradigm of digital government, platformised and datafied, open to citizens' well-recognised – thanks to abundant data analysed by intelligent algorithms – needs. A mature digital transformation of public services can lead to very tangible benefits: the integration of processes and their optimisation and the integration of data, resulting in more efficient management and administration based on data; a different organisation of the administration's work, a new quality of communication and new personalised services. At the same time, there are constant dangers on the horizon related to such applications of new technologies, which will intensify processes of discrimination or exclusion, or ultimately increase the state's control and power over the citizen, leading to a kind of authoritarian surveillance. Hopes for tangible benefits from digital transformation must therefore be combined with a pragmatic awareness of

45 O. Davies, G. Freeguard, M. Shepheard, *Digital government during the coronavirus crisis*, Institute for government, 2020, p. 42, https://www.instituteforgovernment.org.uk/sites/default/files/publications/digital-government-coronavirus.pdf (online access: 21.12.2020).

the technological, operational and organisational barriers and an understanding of the potential risks and threats, manifested both by decision-makers, employees of public institutions and, above all, by citizens themselves.

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Specyfika transformacji cyfrowej sektora publicznego

W niniejszym artykule skupiamy się na wskazaniu specyfiki transformacji cyfrowej w sektorze publicznym. Celem publikacji jest przestawienie głównych mechanizmów wynikających z wprowadzania innowacji cyfrowych, zmieniających funkcjonowanie sektora publicznego. Wychodzimy od omówienia technologicznych uwarunkowań transformacji cyfrowej, krótko charakteryzujemy zastosowania komputerów i internetu w administracji publicznej skutkujące rozwojem e-usług i administracji. Główną część artykułu poświęcamy omówieniu specyfiki wdrożeń nowych technologii cyfrowych w administracji publicznej, skupiając się głównie na technologiach sztucznej inteligencji i blockchaina. Stawiamy tezę, że wpływ innowacyjnych technologii cyfrowych na standardy funkcjonowania i strukturę administracji publicznej należy analizować przez pryzmat powiązanych ze sobą, a charakterystycznych dla gospodarki cyfrowej mechanizmów datafikacji i platformizacji. Przyjęta metodologia, która bazuje na analizie literatury oraz analizie wdrożeń nowych technologii w administracji publicznej w państwach UE, wskazuje na wciąż pilotażowy, wyrywkowy i nietransformacyjny charakter tych wdrożeń, częściowo wynikający z braku ugruntowanych metodologii do badania i oceny dojrzałości transformacji cyfrowej sektora publicznego.

Słowa kluczowe: sztuczna inteligencja, blockchain, transformacja cyfrowa, e-usługi, sektor publiczny