# Potential and Opportunities for Using Big Data in Public Administration

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**Abstract**

**[Purpose]** The purpose of the study was to highlight the specific features of using big data and artificial intelligence in public administration.

**[Methodology/approach/design]** Economic and statistical analysis methods were used to process the data, including the Wilcoxon statistical method for comparing trends.

**[Findings]** It was found that the use of big data in public administration opened up new opportunities for improving the efficiency of public services through accurate analysis, forecasting, and automation of processes. However, along with these capabilities, risks were also identified, in particular, privacy issues, the possibility of information abuse, and technical issues that required careful management and security measures to minimise negative consequences. A review of the use of big data in public administration in the UK, Finland, and Singapore revealed different approaches to integrating such data into public administration. It was determined that the UK focused on transparency and citizen participation through open data, Finland in its approach focused on data security and personalisation of services, and Singapore used big data to improve infrastructure and urban planning. The selected countries demonstrated various models and strategies that outlined the main success factors and their impact on the effectiveness of public services. Based on this international experience, Ukraine was recommended to implement integrated analytical platforms for big data processing, ensure a high level of information security, and develop personalised services for citizens.

**[Practical implications]** The results highlighted the importance of integrating advanced big data processing technologies to improve the efficiency and transparency of public

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administration in Ukraine. Further research may focus on adapting and implementing successful international practices of using big data in public administration, considering the specifics of the Ukrainian context.

**Keywords**: Artificial Intelligence. Public Sector. Digital Transformation. Personalisation. Transparency. Data Governance.

## INTRODUCTION

The use of big data is gradually becoming important for both the private sector and public administration. In business, big data analytics allows reducing costs, optimising customer interactions, and increasing profitability. The same benefits can be effectively applied by government and local governments to improve the efficiency of public administration. However, the introduction of new technologies in this area should not be limited to theoretical discussions but should find its practical application (ADELEYE et al., 2024).

The use of big data should consider the right to privacy and other rights of citizens, because data analysis can both identify legislative gaps and invade privacy (DEMCHYNA et al., 2024; ZAPLATYNSKYI et al., 2024). Thus, the issue of using big data in public administration is extremely relevant for modern Ukraine, especially when the country has been in a state of prolonged war since 2014. Big data can help allocate resources to support displaced citizens, allocate funds to needed medical centres, and identify social issues that may be amplified during wartime.

In addition, it is important to emphasise that the use of big data in public administration can be a driving force for innovation and reform (ALI AL-JUMAILI et al., 2023). By analysing large amounts of information, government agencies can identify the inefficiencies in existing processes, predict socio-economic trends, and develop more adaptive and transparent policies (BUIL et al., 2016; PIERA et al., 2016). Such efforts will not only contribute to improving the effectiveness of public administration but also strengthen citizens' confidence in state institutions. In the face of rapid technological changes and global challenges, the introduction of big data analysis is not just a desirable but a necessary step for modernising public administration in Ukraine (APANASYUK, 2024).

The analysis of literature sources on the potential and possibilities of using big data in public administration revealed a number of main areas and gaps in research. One of the important problems is the lack of attention to big data management issues and their impact on the effectiveness of decision-making in the public sector. The study by A. Yukhno (2024), M. Zhan (2017), N.V. Grytsiak

and O.S. Tverdokhlib (2022), B.V. Dziundziuk (2023) showed that digital transformation and the introduction of big data analysis technologies can significantly improve the efficiency of public administration. The researchers investigated specific aspects of the use of big data but did not focus on the specifics of integrating these technologies into public policy at all levels.

A significant number of researchers, in particular, R.V. Yakovliev and Y.V. Ishchenko (2020), P. Plantinga (2022), N. Margetts and R. Dunleavy (2024), considered the opportunities and challenges of implementing big data in the context of specific regions or industries. However, these studies were limited to individual aspects, such as the impact on the efficiency of administration or the political economy of digital governance, and the lack of a comprehensive analysis of the interaction of big data with other digital tools and technologies, such as artificial intelligence.

R. Li et al. (2024) showed that the introduction of big data can change management approaches, but they did not highlight all possible social consequences. B. Berkat et al. (2024) demonstrated that the use of big data and artificial intelligence in educational management can have a positive impact on the quality of education, but this is only one of many possible applications.

Studies by R. Li et al. (2024) and M.H. Sazu and S.A. Jahan (2022) demonstrated opportunities for improving management efficiency through data use, but coordination issues between different government departments remain open. It is necessary to explore how big data can help improve cooperation between authorities at the local, regional, and national levels. A. Guenduez et al. (2020) pointed out the importance of considering the technological framework and possible risks, but the issues of data privacy and personal information protection remain rather neglected.

While existing studies focus on improving management efficiency through big data, there is insufficient attention given to its integration into public policy at all levels. Most studies address specific aspects, such as the impact on administrative efficiency or the political economy of digital governance, but fail to consider how big data interacts with other technologies, such as artificial intelligence. Additionally, issues of coordination between different government bodies and the management of big data across various levels of government remain underexplored. Also, privacy concerns and the protection of personal data are not sufficiently addressed in relation to the social and ethical implications of using big data in public administration.

The purpose of the study was to develop recommendations for Ukraine based on the analysis of the use of big data in public administration in leading countries of the world to improve their use in the country's public sector.

To achieve this goal, the following tasks were set:

1. to define features of using big data in public administration and reveal their opportunities and risks;
2. to consider the use of big data in public administration in the UK, Finland, and Singapore;
3. to identify ways to improve the use of big data in public administration on the example of Ukraine.

## MATERIALS AND METHODS

This study collected and analysed data on the prevalence of big data use to determine the main trends and forecasts for future years. For this purpose, information was collected on the volume of revenue of the big data market in the world since 2011 with forecasts for the periods 2024-2027, the share of global revenue of the big data market by major segments since 2013, and forecasts for 2024-2027. The data source was information and analytical resources, in particular, Statista (2024a, 2024b), Google Trends (2024), the World Economic Forum (2024, 2021), and the Global Government Forum (2024). First, an assessment of the popularity and prevalence of big data use in government and legislation was made based on data from Google Trends (2024). The period from 2018 to 2024 was selected for the study, which allowed tracing the dynamics of changes over the six years. The geographical scope of the analysis covered all countries of the world, which enabled a global assessment of trends. The collected data was organised and systematised for further analysis, which included economic and statistical analysis. To assess the statistical significance of differences between different segments and periods, the Wilcoxon criterion was used to conduct a nonparametric comparison of the medians of two dependent samples. The Wilcoxon criterion was used to compare the change in revenue from segments like Big Data Services, Big Data Hardware, and Big Data Software between 2013 and 2027. This method determined whether there were significant changes in revenue and shares of the big data market over time and between segments, which provided a more understanding of the development and trends in the big data market.

Next, a review of the use of big data in public administration was conducted on the example of leading countries in the world, in particular, England, Singapore, and Finland. These countries were chosen because of their significant achievements in implementing and using big data technologies to improve public services and management processes. England was chosen for its innovative approach to open data and technology integration in the country's public sector (World Economic Forum, 2024, 2021). Singapore has distinguished itself by its advanced application of big data to develop smart cities and improve citizens' quality of life. Finland has demonstrated effective solutions for data

privacy and service personalisation. Information for review was collected through the analysis of official international reports, specialised sources, and examples of practical applications of big data in these countries (Open Data Barometer, 2017; Global Government Forum, 2024). The study considered Regulation of the European Parliament and of the Council No. 2016/679 "On the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation)" (GDPR), an EU regulation that sets out the rules for collecting, processing and storing personal data of citizens of the European Union and the European Economic Area. Based on this analysis, the most successful practices were identified that can be adapted to improve management processes in public administration in Ukraine, considering the specifics of the local context and needs (Analytics.gov, Singapore's whole-of-government..., 2023; Singapore government focuses..., 2024; SAMOKHODSKYI, 2023).

## RESULTS

### Features of Using Big Data in Public Administration: Opportunities and Risks

At the beginning of the 21st century, the Internet radically changed social and economic life, opening up new horizons for information and technology. Advances in data creation and processing technologies have made collecting, storing, and analysing large amounts of information much easier and more accessible. The Internet, which provides fast and seamless access to data, facilitated the distribution of big data, making it much easier and faster.

Big data is defined as large and complex data sets that cannot be efficiently processed by conventional processing methods due to their huge volume, diversity, and speed of generation (KOLBAYEV et al., 2024; IKLASSOVA et al., 2024). According to the Oxford dictionary, it is a term that describes large amounts of data that go beyond the capabilities of conventional data processing applications due to their volume, the variety of data types, and the speed with which they are created and need to be processed (Oxford Learner's Dictionaries, 2024). Managing such data requires specialised technologies and tools for their analysis and processing since traditional systems do not cope with the volume and complexity of information.

The popularity and prevalence of the use of big data in the world (direction – government and legislation) is confirmed by Google Trends data (Figure 1).


**Chart 1 –** Search queries "big data" in the direction "government and legislation" for 2018-2024 around the world

*Source: Google Trends (2024).*

Thus, as the graph in Figure 1 shows, interest in big data in public administration tended to decline during 2020-2021, but the number of search queries increased significantly between 2021 and 2022. However, in the period from 2023-2024, an even trend was imposed, without an increase.

Figure 2 shows the dynamics of revenue in the global big data market since 2011 with a forecast for 2024-2027. Global big data market revenue is expected to reach USD 103 million in 2027.

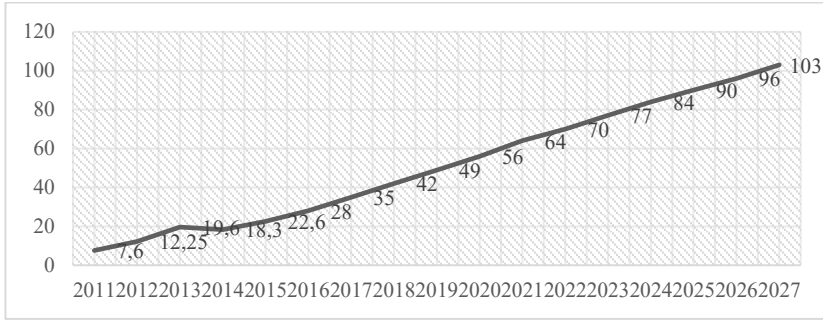


**Chart 2 –** Global big data market revenue since 2011 with a forecast of 2024-2027, million USD

*Source: compiled by the authors based on Statista (2024a).*

Thus, as the graph in Figure 2 shows, the volume of revenue from the global big data market has shown steady growth since 2011, with a gradual acceleration recently. The market grew from USD 7.6 million in 2011 to USD 70 million in 2023, reflecting significant interest and increased investment in this area. Figure 3 shows the structure and dynamics of the global revenue share of the big data market since 2013 with the forecast for 2024-2027 by the main segments – services, hardware, and software.

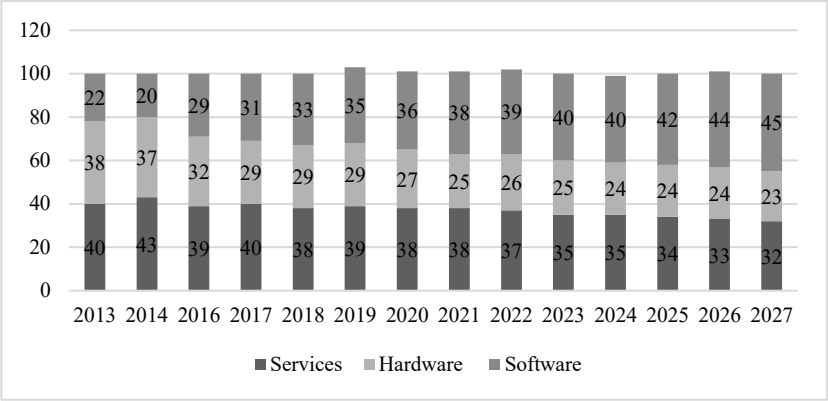


**Chart 3 –** Global revenue share of the big data market since 2013 with a forecast for 2024-2027 by major segments, %

*Source: compiled by the authors based on Statista (2024b).*

During the analysed period, a clear trend of changing the balance between different segments of the big data market can be observed. Services and hardware are gradually losing ground, while software is steadily strengthening, becoming the main area of development (AVTALION et al., 2024). This situation indicates the growing importance of technological solutions that can provide innovation and efficiency in working with big data, especially in the context of digital transformation and the development of intelligent systems.

The scientific community highlights the following opportunities for using big data in public administration (Table 1).

| No. | Opportunities | Application |
|---|---|---|
| 1 | Improvement of the decision-making process | Analysis of large amounts of data allows identifying trends and patterns, which contributes to more informed management decisions. For example, in the healthcare system, the analysis of data on the spread of diseases based on medical reports and statistics, helps to more effectively allocate resources for treatment, organise vaccination, and develop preventive measures in high-risk areas. |
| 2 | Resource optimisation | Data can be used to optimise resource consumption, such as energy, water, and infrastructure. For example, in the energy sector, the analysis of data on electricity consumption in buildings of state institutions and educational |

| | | |
|---|---|---|
| | | institutions allows identifying peak loads and inefficient energy use. Based on this data, it is possible to optimise energy consumption, implement energy-efficient technologies and reduce energy costs. |
| 3 | Increase of transparency and accountability | Open data can be used to increase transparency in management and ensure public control. For example, in the public procurement management system, open data on tenders allows citizens to check information on suppliers, contract terms and costs. This helps to identify possible corruption schemes and unfair practices. For example, public procurement platforms such as Prozorro in Ukraine provide access to information about all tenders and concluded contracts. |
| 4 | Improving with interaction with citizens | Big data can be used to better understand the needs and expectations of citizens, which contributes to improving the quality of services. For example, in the field of public opinion analysis, big data from social networks, surveys, and forums allow authorities to better understand public opinion and respond to problems in a timely manner. Monitoring social networks can reveal resentment about certain policy decisions or social initiatives, which helps to quickly respond to these problems. |
| 5 | Crisis forecasting and management | Big data can help authorities anticipate and manage crisis situations by providing timely risk identification and effective emergency response, which includes monitoring potential threats, analysing data for early warning, and coordinating actions during crises. For example, big data from medical records, social media, and global health monitoring systems helps track disease outbreaks and predict their spread. For example, during the COVID-19 pandemic, data on new cases, hospitalisations, and movements of people were used to model the development of the epidemic and manage medical resources. |

| | | |
|---|---|---|
| 6 | Support for social programmes | Data analysis can help in the development and implementation of social programmes, focusing them on the real needs of the population. Big data allows allocating resources more efficiently among social assistance recipients. For example, analysing data on beneficiaries of social programmes can help avoid duplication of assistance and ensure that assistance reaches those who need it most. |

**Table 1 –** Key opportunities for using big data in public administration
*Source: compiled by the authors based on M.H. Sazu and S.A. Jahan, (2022); K. Löfgren and C.W.R. Webster (2020); M. Abuljadail et al. (2023).*

Thus, as can be seen from Table 1, the use of big data in public administration provides new opportunities for improving the quality and efficiency of public services. The integration of these technologies into various aspects of management processes helps not only better respond to current challenges but also actively solve problems, optimise resources, and increase overall social efficiency. The use of big data in management reduces the level of uncertainty, ensuring decision-making based on factual information, which increases the accuracy and effectiveness of management measures. This helps to optimise the use of resources and prevents their excessive consumption, which leads to economic benefits and environmental benefits. Data transparency also contributes to the creation of an open government, allowing citizens to control the activities of the authorities, reducing corruption risks and building trust in state institutions. Analysis of social trends helps to adapt public services to the real needs of citizens, and forecasting crisis situations allows the government to respond faster to emergencies, minimising negative consequences for society (KIREYEVA et al., 2021).

The use of big data in public administration carries certain risks, even though it brings many advantages (SPASKA et al., 2025). One of the main risks is to protect the citizens' privacy. The collection and analysis of large amounts of personal data may result in privacy violations if the data is not properly protected (REBENOK et al., 2024). For example, in some cases, when government agencies analyse data from social media or medical records, there is a risk that this data may be used for unauthorised surveillance or even manipulation. A risk that also requires attention is the potential misuse of information. In countries with authoritarian regimes (such as China), big data can be used to control and suppress opposition (LÖFGREN and WEBSTER, 2020). In addition, dependence on algorithms and analytical models can lead to bias in decision-making if algorithms do not take into account all the nuances and contexts. Incorrect or unjustified use

of data can lead to unfair resource allocation or even social injustice. For example, in May 2018, the UK faced serious challenges related to the use of algorithms and data management in the public sector. The Minister of Health blamed a computer algorithm for errors in cancer screening, South Wales Police admitted that their facial recognition system had produced thousands of false positives, and Amnesty International criticised the Metropolitan Police database for racial discrimination. At the same time, Cambridge Analytica, which came under legislative pressure for abusing data from Facebook, was forced to stop its activities. These events clearly demonstrated the risks of algorithmic data management for government agencies (ANDREWS, 2018).

Thus, while big data opens up new horizons for improving public administration, it is important to assess and manage risks to ensure the ethics and safety of using such technologies.

## Overview of the Use of Big Data in Public Administration in the Leading Countries of the World

In England, big data plays a key role in improving the delivery of public services, especially in the healthcare sector. For example, the National Health Service (NHS) has implemented numerous initiatives to monitor the quality of health services and improve their availability. As of May 2023, data showed that the number of patients who waited more than 18 months for treatment decreased by more than 90% compared to September 2021. Big data analysis of patient processing delays and prompt problem response enabled this. NHS Digital, which is responsible for collecting and processing medical data, provides transparent reports on progress, including improvements in emergency and emergency services and in cancer treatment (Global Government Forum, 2024). This approach helps not only to improve medical care but also to optimise the allocation of resources to improve the efficiency of hospitals.

The UK government is also actively using big data to combat fraud in the public sector. As part of this initiative, the Public Sector Fraud Authority has been using data and analytics to identify and combat financial abuse since 2021. The data allows prioritising areas where fraud risks are greatest and developing effective strategies for restoring taxpayer funds. For example, in 2022, new analytical tools were introduced that helped to identify and stop dozens of cases of abuse of budget funds. The above information demonstrated how the use of big data can help in the fight against the public fraud sector by providing better transparency and accountability in the use of public finances (Global Government Forum, 2024).

The UK is actively integrating big data into public administration, trying to improve public services and improve the efficiency of government structures.

In October 2022, the UK Government announced contracts worth GBP 2 billion as part of its big data and analytics programme. This project, which lasted two years, aims to improve the provision of public services, while at the same time drawing attention to new technologies in the post-pandemic era (HORTON, 2022).

As part of this programme, Crown Commercial Service (CCS), which purchases for government departments and other public organisations, has signed contracts with many well-known and emerging technology companies. The government sees the great importance of big data and analytics as a critical component of business functions, in particular, in the introduction of new missions to improve access to public data and its effective use (HORTON, 2022). Such contracts are intended to support the national data strategy, which includes changes in the regulation and protection of data to be adapted in the post-Brexit UK. The adoption of these technologies requires the involvement of chief data officers (CDOs) in government, which demonstrates the growing role of big data in shaping strategies and improving public services. Although technologies such as Amazon Web Services Cleanrooms and Amazon Datazones exist that automate data sharing, the UK government lacks the proper structure and policies to effectively utilise these opportunities.

Attention should also be paid to the experience of Finland, which has demonstrated best practices in using big data to improve public administration, especially in the country's capital, Helsinki. As part of a collaboration between the World Economic Forum, the Finnish government, Edelman, Splunk, and the Patrick J. McGovern Foundation, a new approach to data management was developed in 2021 to ensure more efficient use of data. The main goal of this approach was to optimise the provision of personalised and targeted services for city residents, reduce bureaucracy and increase accessibility. One of the main achievements was the introduction of a system that separates the functions of data storage, anonymisation, and processing from specific tasks. This allowed, for example, to automatically send text messages to families looking for places in kindergartens. In January 2021, more than 5,500 families received notifications with offers for places in preschool institutions, and nine out of ten families accepted these offers (World Economic Forum, 2021).

In addition, new data management tools and processes have been developed in collaboration with the World Economic Forum, including the following. Hybrid cloud architecture for personal data is a technology-neutral, GDPR-compliant template that ensures the highest level of anonymity when processing sensitive data (Regulation of the European…, 2016).

Helsinki Anonymiser – a set of tools and practices for anonymisation, which is easily implemented in various projects (World Economic Forum, 2021).

The Helsinki data-based service ladder is a modular project management tool that provides a framework for improving public services through data. Thus, this approach has helped Helsinki not only improve its internal processes, but also become an example for international cooperation and interaction with key scientific organisations and companies.

Singapore's experience in applying big data to governance is a prime example of integrating modern technologies to improve the efficiency of public services and ensure information security. In 2022, the Singapore government expanded its data processing platform, GovTech Analytics.gov (AG), to cloud services via Government on Commercial Cloud (GCC). This expansion has enabled powerful analytics tools and scalable computing resources that provide more than 1,600 users from 80 government agencies with access to advanced data analysis and machine learning capabilities. Major agencies that have joined the platform include the Ministry of Manpower, Ministry of Foreign Affairs, Housing and Development Board and SkillsFuture Singapore (Analytics.gov, Singapore's whole-of-government…, 2023).

The Analytics.gov platform was designed to be a secure environment for running sophisticated data analytics and machine learning within government architecture and security requirements (OCHUBA et al., 2024). AG allows quickly implementing analytical projects without having to create separate systems for each agency, which significantly reduces costs and duplication of effort. The platform supports a variety of use cases, such as analysing and predicting citizen feedback data, developing chatbots, automating data processing for grant verification, planning campaigns, and improving processes (Analytics.gov, Singapore's whole-of-government…, 2023).

Singapore's experience in using big data in government has demonstrated significant development and active implementation of innovative technologies. In particular, in 2023, Singapore launched the "Smart Nation Sensor Platform" project, which integrates more than 10,000 sensors across the city to collect data on the environment, transport and infrastructure. These sensors monitor various aspects of urban life, from air quality to traffic, allowing the government to obtain real-world data to improve planning and management decisions (Singapore government focuses…, 2024).

Additionally, "Data.gov.sg" – the state open data portal, since its launch in 2011, has become an important resource for ensuring transparency and access to state information. As of 2024, the portal contains more than 8,800 data sets from 60 government departments and agencies, which contributes to the active use of data by the public and the private sector for innovation and development of new solutions (Singapore government focuses…, 2024).

An important initiative is also the introduction of the "Smart Nation Platform", which provides centralised data processing and analytics, in particular, through the use of artificial intelligence and machine learning technologies, which allows reducing data processing costs and increasing the efficiency of government services, providing more accurate and faster solutions to public problems.

Through these initiatives and continuous technology improvements, Singapore continues to lead the way in implementing big data in government structures, setting ambitious goals for developing smart cities and improving the quality of life of residents.

## Features of Using Big Data in Public Administration of Ukraine and Recommendations for Implementing the Successful Experience of Countries in Improving It

Before the war, Ukraine was one of the leaders among European countries in implementing the open data policy, implementing relevant laws, guided by the principle of "open by design and default" even before the adoption of the relevant EU directive.

According to 2017 data, Ukraine received 47 points (Figure 4) and ranked 17th among 30 countries that made specific commitments to the Open Data Charter (Open Data Barometer, 2017). Unfortunately, this rating was no longer formed.

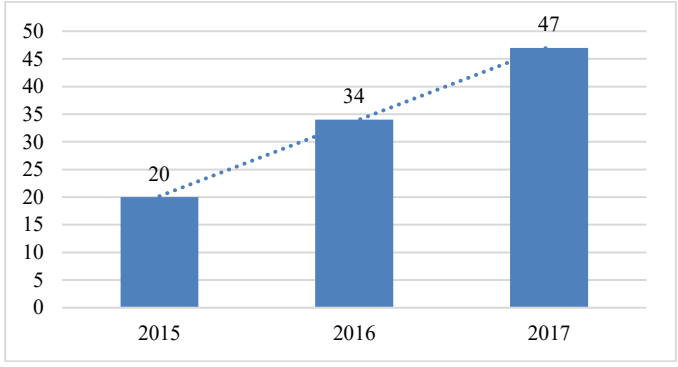


**Chart 4 –** Rating of Ukraine on open data development in 2015-2017, points

*Source: compiled by the authors based on Open Data Barometer (2017).*

Due to the ProZorro system, almost all data on public procurement was open to the public. The e-data platform provided access to public finance data. The enterprise registry, financial statements, and many other important data sets were also opened in open data format.

The above-mentioned successes in the implementation of open data allowed creating numerous platforms for verification of persons, analysis of public procurement, search for court decisions, and environmental monitoring services in Ukraine (Diia, Privat24, eGov, Electronic cabinet of a citizen, On-line House of Justice, Single Window Web Portal, etc.). Statistics for 2021 show that these services were popular, attracting from 5 to 7 million users annually. Ukrainian digital e-governance platforms based on open data have received international recognition as one of the best digital solutions in the world (SAMOKHODSKYI, 2023).

In the construction industry, which will play an important role in the reconstruction of Ukraine after the end of the war, open data from the state architectural and construction inspectorate help to improve the situation with control and transparency of construction. However, with the outbreak of the war, access to data was significantly restricted, which led to the loss of Ukraine's leadership position in this area. Initially, the Open Data Portal was completely blocked, but later partial access to some data sets was restored. The process of returning to full access continues to this day (SAMOKHODSKYI, 2023).

Under conditions of war and martial law, public organisations in Ukraine actively appeal to the government with demands to resume the publication of key data sets. The RISE Ukraine (2023) coalition has compiled a list of priority data needed to ensure a transparent reconstruction process for the country.

It must be recognised that, even in times of war, open data remains essential for preventing corruption, improving government efficiency and building confidence in budget allocation processes. At the same time, there is a risk that Russia may use some data to improve the effectiveness of its military operations, especially in the occupied territories, including personal data and information about infrastructure and enterprises. Therefore, the balance between openness and security is a complex task that requires a cautious approach, but excessive restriction of data access is not the optimal solution in a war environment (CIANCARINI et al., 2024).

For successful transformation in data management, Ukraine needs to adopt a comprehensive approach that covers all stages – from data collection and storage to data processing and analytics, including the integration of the latest achievements in the field of artificial intelligence to ensure that data platforms meet modern requirements and are able to handle new types of data and loads. Modern data platforms need to be adapted to work with large amounts of information coming in real-time and to integrate data from different sources (KIREYEVA et al., 2019).

It is important to focus on implementing technologies for obtaining real-time data, which will allow government agencies to respond more quickly to

changes in the situation, increasing the efficiency of serving citizens and improving their experience of interacting with government agencies.

It is necessary to focus on creating and managing data as products, which involves the development and implementation of new pipelines for data that will ensure efficient data collection, processing, and use. It is important to integrate new practices of cooperation and data exchange between different organisations to optimise processes and achieve strategic goals. The implementation of such practices will reduce data duplication and improve data quality. Data pipelines are processes that help organise the path that data takes from the moment it is collected to the moment it becomes ready for use (TROFYMCHUK et al., 2019). This can be represented as a kind of pipeline, where raw materials (data) get to the beginning, and at the output there is a finished product – clean, processed data ready for analysis or decision-making. This process allows avoiding errors, keeping data in order, and ensuring fast processing. As the role of the CDO becomes increasingly important, it is necessary to ensure that it is strengthened by government organisations. The UK's successful use of such specialists serves as an example.

A CDO is a manager who is responsible for managing data in an organisation and ensures that the data held by the company is properly collected, stored securely, and used to the maximum benefit (BISENOVNA et al., 20024; AVIV et al., 2023). The main goal of CDO is to make sure that data brings real value to users, helps them make better decisions, and increases the efficiency of the organisation. They also ensure that the data is used in accordance with legal and ethical standards. CDOs should not only manage artificial intelligence initiatives, but also be responsible for ensuring that new technologies are integrated into the day-to-day operations of organisations.

Finnish experience in integrating big data into public administration can be useful for Ukraine through the introduction of effective approaches to data anonymisation that ensure confidentiality and comply with GDPR standards (Regulation of the European…, 2016). In Ukraine, it is necessary to develop personalised services, using data for accurate recommendations, as is done in Helsinki, in particular, for the selection of educational institutions. It is also important to invest in new technologies and tools for transparent data management that will improve the efficiency of public services. Adapting national legislation to modern standards in the field of data protection and public administration can help Ukraine improve its management processes and the quality of public services.

Singapore's experience in integrating big data can also be useful for Ukraine. Implementation of a centralised data processing platform similar to GovTech Analytics.gov, can reduce costs and avoid duplication of effort. Creating

sensor platforms like the "Smart Nation Sensor Platform" will help to monitor the environment and infrastructure for better planning. Expanding open data through portals like "Data.gov.sg" will promote transparency and innovation. These initiatives can significantly improve the efficiency and quality of public services in Ukraine.

The implementation of big data in public administration offers significant opportunities for Ukraine's digital transformation, yet requires deeper consideration of ethical dimensions and social consequences. While technological benefits are evident, potential inequalities in service delivery may arise if digital literacy gaps remain unaddressed, potentially excluding vulnerable populations from improved services. Privacy concerns extend beyond mere data protection to questions of democratic oversight, requiring robust frameworks that balance security imperatives with citizen rights, particularly in Ukraine's wartime context where surveillance capabilities must be carefully governed.

For practical implementation, Ukraine should consider adopting specific technologies such as Comprehensive Knowledge Archive Network for open data management—the same platform powering Data.gov.sg—modified to meet Ukraine's security requirements. The Microsoft Azure Government Cloud platform offers another viable option with its advanced security protocols designed specifically for sensitive government operations. To implement these effectively, Ukraine should pursue partnerships with the European Digital Innovation Hub network for knowledge transfer and technical assistance, while leveraging existing relationships with Estonia's e-Governance Academy, which has relevant experience in both digital transformation and cybersecurity during conflict.

Ukraine faces unique implementation challenges stemming from its wartime context. Physical infrastructure vulnerabilities require distributed cloud systems with robust failover mechanisms and data redundancy across secure locations. The war has created unprecedented data security concerns, necessitating advanced encryption protocols and segregated data architecture that separates critical infrastructure information from less sensitive datasets. Additionally, resource constraints amid reconstruction priorities demand phased implementation focusing initially on systems supporting humanitarian aid distribution, displaced persons tracking, and reconstruction planning. These targeted recommendations acknowledge Ukraine's specific circumstances while providing actionable pathways toward effective big data implementation that balances transparency and security requirements during the ongoing conflict and eventual reconstruction period.

## DISCUSSION

The study results emphasised that big data has become an integral part of modern life. It was found that if used correctly, they can significantly improve the sphere of public administration, increasing its efficiency, effectiveness, and the level of satisfaction of citizens. Such results are consistent with those of other researchers (ABULJADAI et al., 2023; MERGEL et al., 2023), who focused on the possibilities of using artificial intelligence and big data in public administration. These advantages are conditioned by a significant increase in the accuracy of decision-making, speeding up internal information processes, and reducing operating costs associated with the decision-making process. This was made possible by modern transformation processes, in particular, the digitalisation of everyday life and the emergence of information technology developments that were specially created for the needs of public administration. Such technologies allow processing huge amounts of data, providing public and local government bodies with information that helps them to perform their tasks and functions more efficiently.

I. Pencheva et al. (2018) analysed the transformational changes that occur in government structures as a result of the introduction of the latest technologies, such as big data and artificial intelligence, and stressed the need to adapt public administrations to new realities. The researchers discussed the potential of big data and artificial intelligence to improve the efficiency of public administration, and pointed out challenges, in particular, in matters of ethics, privacy, and data interpretation.

Research by A. Rakšnys et al. (2021) focused on the capabilities of big data and artificial intelligence to improve the efficiency of public administration, which is similar to the findings in this study. The researchers emphasised the importance of accurate analysis and forecasting, which is consistent with the findings in the current study on the potential of these technologies. However, their study did not address specific risks such as privacy concerns and data misuse, which are important aspects of the current analysis.

The study by K. Löfgren and S. Webster (2020) analysed how big data can affect the effectiveness of digital management, using the "value chain" approach to analyse the development of this area. As in the current study, the researchers also drew attention to both positive aspects and risks, such as data quality and reliability, ownership issues, and ethical issues related to privacy and surveillance. This was largely consistent with the current study, which also discussed the new opportunities that big data has opened up in the field of public administration, but at the same time highlighted the challenges associated with them. However, this study is more practically oriented because it uses economic and statistical analysis

to compare trends and offers specific recommendations for Ukraine, based on the experience of other countries. In addition, the study shows how the UK, Finland, and Singapore have integrated big data into government processes in different ways, which has helped to see a deeper picture of the application of these technologies in different countries.

Van der Voort et al. (2019) focused on the potential threats and risks associated with the use of big data in public administration. In particular, they emphasised that big data can give analysts the ability to act as autonomous agents, which can lead to self-interest rather than functional task execution. This, in turn, can affect the legitimacy of political institutions and the decision-making process in public administration. The researchers emphasised that the impact of big data should not only be considered in terms of its functional potential, but its possible implications for institutional structure and decision-making should also be considered.

L. Andrews (2018) also emphasised in his study that scientific research in public administration has largely ignored technological changes. The era of algorithms and "big data" poses new challenges for public leaders who already face them in different jurisdictions. Algorithms can create certain problems for government agencies, as their use requires a deeper understanding and solution of ethical and value issues that affect governance and regulation (IBRAYEVA et al., 2016). L. Andrews also pointed out that public value theory can serve as an analytical approach to exploring how government leaders address these issues, especially based on the UK experience.

The current study highlights the practical experience of using big data in public administration on the example of the leading countries of the world, and it is determined that Finland has actively integrated big data into public administration, demonstrating a number of main characteristics. The country has also developed new approaches to anonymisation and data processing, which have made it possible to ensure high confidentiality of information, in particular, through hybrid clouds that comply with GDPR standards (Regulation of the European…, 2016). Finland has also focused on creating personalised services for citizens, which is achieved through the use of data for accurate and timely offers.

Such results can also be seen in the study by D. Mingazov et al. (2024), who used mining and unsupervised learning techniques to extract graphs from big data generated by public administration software logs in Italy. The researchers grouped functions related to certain operations in public administration (for example, managing turnovers, tax withdrawals, and budget changes) using clustering. After that, they used inductive mining on clusters to extract process models that were visualised using business process notation. This allowed creating generalised ways to perform specific operations that can be used for

detailed process modelling, communication, and analysis of work flows in public administration. Thus, this study paved the way for modelling public administration operations in the form of knowledge graphs suitable for integration into ethical artificial intelligence systems.

M.M. Uzun et al. (2022) also noted that big data can significantly modernise public administration, but the emphasis on general transformation technologies may not always consider the specifics of different countries. The current study analysed the practices of the UK, Finland, and Singapore and found that these countries have different approaches to integrating big data, which contrasts with the more general approach of Uzun et al. (2022), and stressed that specific models for successful big data integration may vary depending on the country context.

The study by M. Damar et al. (2024) offered a general overview of transformational technologies, but did not analyse in detail specific examples from the practice of different countries. This may limit the applicability of their findings to the Ukrainian context, where different strategies and approaches to big data may be more relevant. On the other hand, N.A. Bhat and R. Kaur (2020) considered intelligence and big data in the context of illiberal democracy, which created a different political context compared to the democratic models used in the current study.

Thus, the current study has significant value due to its ability to show how the use of big data can significantly improve the efficiency of public services. This study highlights the importance of integrating advanced technologies to increase transparency and efficiency of public administration in Ukraine, which will help to optimise management processes and improve the quality of public services. However, the study also has its own drawbacks. The lack of contextual and local aspects can reduce the accuracy of applying results in different regions. In addition, underestimating the impact of economic and political changes, social and cultural factors can lead to a lack of adaptability of recommendations to real-world conditions. Expanded research with these aspects addressed could improve the practical value and effectiveness of the strategies proposed in this study.

## CONCLUSION

Thus, the use of big data in public administration and local self-government has obvious advantages and potential opportunities. They help to identify hidden patterns that are not always apparent to the casual observer, and thus open up new opportunities for optimising various areas of social and economic life: from government and municipal administration to healthcare, security, finance, transport and education. With this in mind, it is worth continuing scientific research on the introduction and use of e-governance tools in key sectors

of Ukraine to support decision-making processes and automation of administrative tasks.

The results highlighted the importance of integrating advanced big data processing technologies to improve the efficiency, transparency and adaptability, of public administration in Ukraine. The analysis showed that the use of big data allows government agencies to respond faster and more accurately to citizens' requests, optimise internal processes, and make more informed decisions. Especially important is the experience of countries such as the United Kingdom, Finland, and Singapore, which have demonstrated effective practices for using big data in various aspects of public administration, which can be adapted to Ukrainian realities. With this in mind, it is important to provide appropriate training and institutional support for the effective use of big data in public administration. It is necessary to create an appropriate infrastructure, develop clear regulations and standards for data processing and analysis, and step up international cooperation to borrow best practices and adapt them to Ukrainian realities. This will not only improve the efficiency of public administration, but also contribute to economic development, improve the quality of life of the population, and strengthen democratic institutions in Ukraine. Informing and engaging the public in data collection and analysis processes is also an important aspect, which will help increase confidence in government agencies and ensure transparency in decision-making. The introduction of feedback mechanisms and interaction with citizens will help not only improve the quality of services provided, but also contribute to the development of civil society, ensuring active participation of the population in government. Consideration of these advanced approaches and recommendations will allow Ukraine to develop modern management processes, while ensuring a high degree of confidentiality and data protection in accordance with international standards.

The study has a number of limitations that may have affected its results. The use of secondary data collected from information and analytical sources potentially affected the accuracy and relevance of information. Coverage of only three countries – the United Kingdom, Finland, and Singapore – limited the possibility of generalising the results for other regions. The specific economic, social, and political conditions of these countries may not fully reflect the Ukrainian context, which created obstacles to adapting the results obtained.

Further research may focus on a detailed analysis of the implementation of specific recommendations in public administration in Ukraine and their impact on the effectiveness of public services. It is also important to explore the latest technologies and techniques for processing big data that may appear in the coming years to further improve management processes.

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